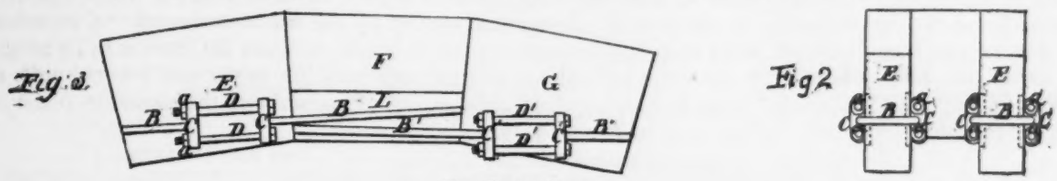
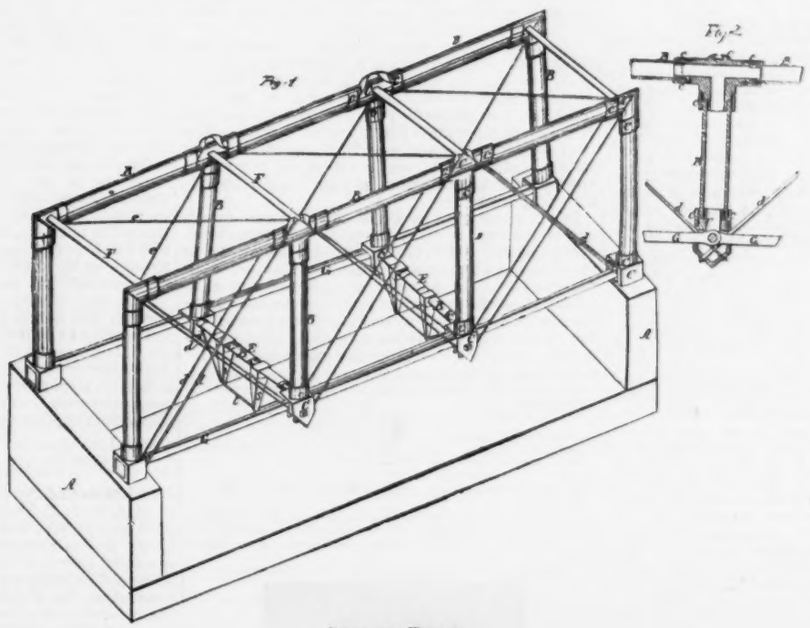
the screw-bolts *D*, placed about the center of the intermediate stone *F*. The rods *B* pass through holes formed between the third stone *G* and fourth stone *H* and around on the inner sides of the stones, where they are connected by bolts in the same manner as described for the outer side. This securely fastens, it is said, the first three blocks. The next series of rods *B*, forming the second "gripe," pass around on both sides of the third block or stone *G*, and encompass the three stones *G H I*, these being clamped with screw-bolts as the first three blocks were. In this manner the whole continuous arch is "griped" and every stone, according to the inventor, is firmly supported by the combined strength of the iron rods *B*, making it of great strength and stability. The same manner of bracing may be applied to a wooden bridge, in which case metal blocks *L* are used, placed on the sides and ends of the blocks around which the gripping devices pass. D. H. Van Duzer's patent expired September 20, 1873.



VAN DUZER BRIDGE.

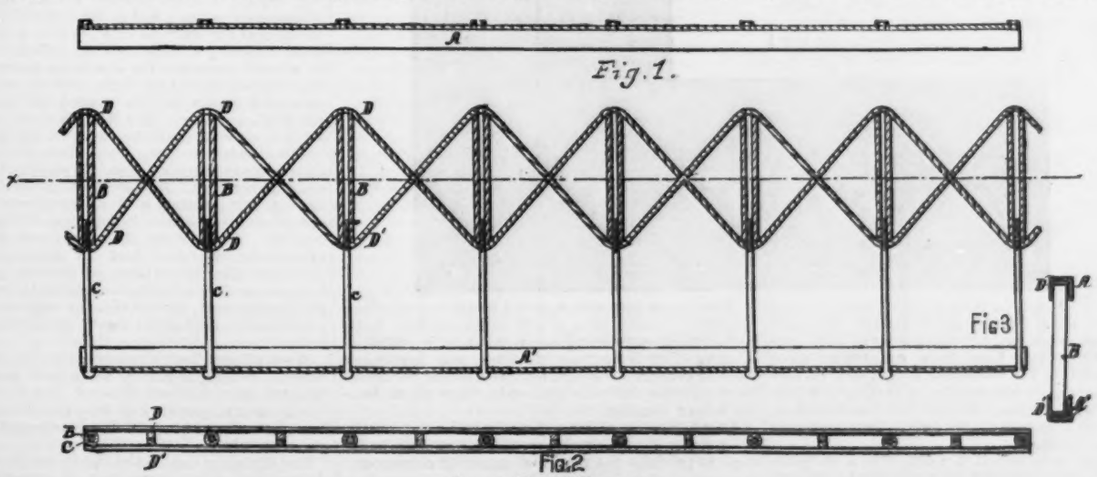
October 18, 1859, Joseph W. Sprague, also of New York, devised a truss bridge made chiefly of boiler iron, and consisting of a series of clutches of peculiar construction, combined with tubular sections and braces.

The upper chord of Sprague's bridge is formed of tubular sections *B*, firmly connected by the clutches *C*. These clutches have bands *c c* adapted to embrace the chords. The end of the clutch is inserted into the end of the section *B* and the band *c* shrunken so that the band clasps the section both inside and outside and holds it in the most rigid manner.



SPRAGUE TRUSS.

The lower chord *G* is made of strong bands of wrought iron, there being a greater number of such bars near the middle of the chord. The girders *E* are also made of tubular iron in sections, connected by clutches and strengthened by braces *t t* and posts *S S*.



JACOB'S TRUSS BRIDGE.

Fig. 1 shows the construction of Enoch Jacob's truss bridge, the protection of which expired January 3, 1874. The

first figure represents a vertical longitudinal section through the central line of truss, the upper chord being separated from the braces and tie rods. Fig. 2 is a section through the truss on the line *X X* of Fig. 1. Fig. 3 is an edge view showing the reception of the brace tubes in the inner part of the double angle iron chords.

The form of double angle iron chords *A A*, besides giving great vertical and lateral strength, forms a close, strong box, against whose inner surface abut the upper and lower bends of the oblique braces in the shape of a short bend as seen in the cuts. Upon the inner faces of each of the bends are received the corresponding ends of the tubular braces *B*. Within the tubular braces, and exactly fitting the bore thereof, are received the screw bolts *C*, having a head at the lower end and a screw and nut at the upper end. The oblique braces are designed to be continuous from end to end of the truss frame, and are made to cross each other at nearly a right angle. Instead of notching these flat bar braces where they cross, they are twisted at the crossing a quarter of a circle, which will bring the bars into contact by the flat faces thereof. *C* represents the vertical tie-bolts which, when the truss is in its proper position, pass through both the upper and lower chords, and are the chief means of maintaining their relative positions.

[TO BE CONTINUED.]

ON THE ADHESIVE STRENGTH OF PORTLAND CEMENT WITH SPECIAL REFERENCE TO AN IMPROVED METHOD OF TESTING THAT MATERIAL.*

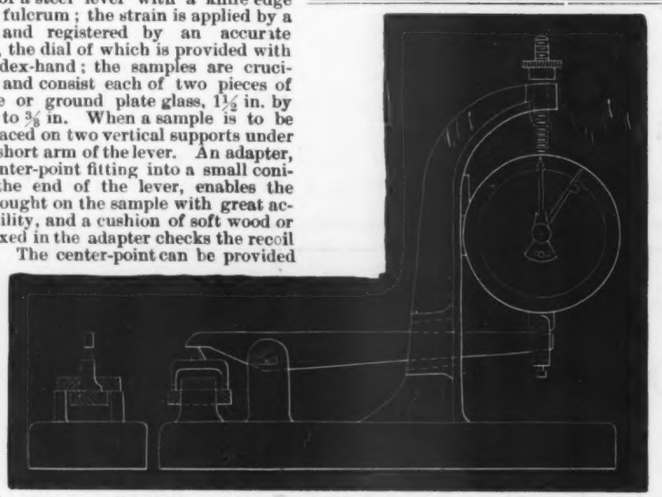
BY ISAAC JOHN MANN.

This communication refers principally to an investigation of the adhesive or cementitious strength of Portland cement, and a description of an improved method of determining its quality and value, with a view to establish a simple and generally recognized standard system of testing.

The author believes that it may be fairly assumed that the principal function of cement is to produce adherence, so as to convert loose or disconnected material into a solid coherent form; and that it may be further assumed that the economy with which this object can be gained will, *cæteris paribus*, be in proportion to the adhesive strength of the cement employed.

Reviewing the history of cement-testing, and the experimental researches connected with it, the conclusion seems almost inevitable that neither of the systems at present in general use—one depending on the cohesive strength of new cement, the other on that of a mixture of cement and sand—are likely to become universal.

The principal test adopted by the author is one of adhesion. It has been used by him for some years with very satisfactory results, and he believes it will be found to possess elements which recommend it strongly for general adoption. The mode of applying the test is extremely simple, involving neither skill nor experience on the part of the operator, and most, if not all the complications of details incident to other systems can be avoided. The simple and inexpensive testing machine designed by the author is shown in Fig. 1. It consists of a steel lever with a knife edge bearing on the fulcrum; the strain is applied by a thumb-screw, and registered by an accurate spring-balance, the dial of which is provided with a maximum index-hand; the samples are cruciform in shape, and consist each of two pieces of sawn limestone or ground plate glass, 1½ in. by 1 in. by ¾ in. to ⅜ in. When a sample is to be broken, it is placed on two vertical supports under the end of the short arm of the lever. An adapter, with a steel center-point fitting into a small conical recess at the end of the lever, enables the strain to be brought on the sample with great accuracy and facility, and a cushion of soft wood or india-rubber fixed in the adapter checks the recoil after fracture. The center-point can be provided



with a screwed end, to permit adjustment in case the cement joint should inadvertently be made thicker than necessary; this, however, is an unlikely contingency. Limestone or ground plate glass are suitable for standard tests; the former because it is readily obtainable, of sufficiently uniform texture, and enters largely into construction, the latter on account of its being homogeneous and easy to obtain.

The cement to be tested is gauged to a suitable consistency, and applied with a spatula to one of the test pieces; the other being placed in position, a slight pressure is sufficient to squeeze out the superfluous cement, which forms a fillet tending to protect the extreme edges of the joint from any "wash" that might occur in the act of immersing the sample, or at any time previous to setting, and which can be removed after the cement has set. When the samples are made they are numbered, and at once placed in water in shallow vessels, which are also numbered or lettered to facilitate identification. After fracture the remaining cement is removed from the test-pieces, which can be used as often as required.

The transition from the German or mortar test to one of adhesion is not so abrupt as would appear. In the former a great number of small pieces of stone are used, in the form of sand; in the latter two pieces only are employed, and the test is thus simplified and better defined. The German test, however, is neither one of cohesion only nor of adhesion, but involves an indeterminate proportion of each, which cannot be considered desirable.

In his investigations of the cementitious or adhesive strength of cement, the author was necessarily obliged to devote considerable attention to the influence of the coarse particles. The test of adhesion alone, even without any qualification as to grinding, would be almost sufficient to determine the practical value of cement, the weakening effect of the coarse particles becoming at once apparent, as will be seen from the following tests:

TABLE I.—EFFECT OF COARSE PARTICLES ON THE CEMENTITIOUS OR ADHESIVE STRENGTH. Age of samples, twenty-eight days.

Percentage of coarse particles	0 fine only	20	40	80	100 coarse only
Average adhesive strength in lbs. per square in.	101	84	57	34	18

Percentage of coarse in the unsifted cement, 49. Cohesive strength of the same after seven days, 430 lbs. per square inch. Number of tests, twenty. Test pieces, sawn limestone.

The coarse particles referred to above were those stopped by a silk sieve of 176 meshes to the lineal inch, the meshes being about 0.004 in. by 0.004 in. A sieve of such fineness, although not heretofore used in ordinary testing, has been found to afford more definite and reliable results than those having larger meshes.

Another series of tests gave the following results after seven days' immersion, the same sieve being used to produce the required degree of coarseness:

Fine cement only	91 lbs. per square inch
25 per cent. of coarse particles	63 " "
75 " "	26 " "
Coarse particles only	8 " "

Cohesive strength of the cement as supplied, 532 lbs. per square inch. Age, seven days.

Although these and numerous other tests of a similar character have been sufficiently satisfactory and conclusive, the presence of coarse particles may be regarded as introducing an element which might possibly help to interfere with perfect uniformity in results, and which might therefore with advantage be eliminated in a standard test, a simple and obvious alternative will be found sufficient to overcome the objection referred to.

It can hardly be doubted that the strength of a joint made with ordinary cement must be influenced by the fortuitous position which the coarse particles occupy; or, in other words, by the proportion of inert, or comparatively inert particles which happen to be in direct contact with the cemented surfaces. In accordance with this view, the author proposes that one of the standard adhesive tests should be applied after the inert particles have been removed by sifting through a standard sieve.

Cement, as at present received from the manufacturer, so far as concerns the cementitious strength capable of being developed in the period to which ordinary testing must of necessity be limited in practice, consists of a mixture of active, and inert, or extremely sluggish material, and the latter may be considered almost as foreign for the true cementitious portion as so much sand.

This view is supported by the following experiment: The coarse particles stopped by 176 sieve, amounting to 49 per cent. of the cement as supplied, were removed, and sand of approximately the same granulation substituted; the average adhesive strength of this compound or mortar, compared with that of the ordinary cement after seven days' immersion, was—

Sand and fine cement	49 lbs. per square inch.
Ordinary cement	56 " "

Test-pieces, sawn limestone.

Separation of the inert and active portions would be manifestly desirable as forming, in combination with an adhesive test of the latter, a simple means of arriving at a true estimate of both the cementitious and commercial value of any given cement in much the same way as the value of an ore is estimated by the percentage of metal it contains. The author's attention was therefore directed to this part of the subject, with a view to discover, if possible, the degree of pulverization required to convert the unground clinker into active cement capable of developing its cementitious properties within the period allowed in practice for testing purposes.

Some of the principal results of the experiments up to the present time are contained in the following table. Unfortunately, others applying to lengthened periods had to be discarded owing to accidental exposure to frost, which in many cases seemed almost to destroy the adhesive strength. In several instances the coarse particles were rapidly washed in two or three waters to remove a minute quantity of fine cement which adhered to them after sifting. The No. 176 sieve, used to separate the coarse particles, was the finest that could be obtained, arresting from 38 to 50 per cent. of the ordinary cement. No. 103 sieve retained from 25 to 30 per cent.; the unsifted cements required from forty minutes to five hours to set in air, the temperature of which varied from 50° to 70° Fahrenheit. They were obtained from well-known manufacturers, and had an average cohesive strength, after seven days, of 425 lbs. per square inch, their average adhesive strength being 61 lbs. per square inch, and 84 lbs. per square inch after seven and twenty-eight days' immersion respectively.

A set of samples eleven months old, made from cement passing a No. 54 sieve and stopped by a No. 103 sieve, but not washed, and having therefore a minute quantity of very fine cement adhering, showed an average adhesive strength of 21 lbs. per square inch.

The figures given in the table are in some cases the average of six tests, but in general that of three. In these, as in all the other experiments on the adhesive strength recorded in this paper, the test-pieces, unless otherwise stated, were of sawn close-grained limestone, and were placed in fresh water immediately after being cemented together.

The above examples, although far from exhaustive, lead to the following conclusions:

* From Selected Papers of the Institution of Civil Engineers.

1. That so far as concerns a seven days' test, the particles of cement stopped by a No. 176 sieve developed little or no cementing power during that period, and that even some of the less fine particles passing the sieve may be very deficient in cementitious strength. This was further shown to be the case by the following tests: A weight of about 300 or 400 grains of ordinary cement was placed in the sieve (No. 176); after sifting gently for thirty seconds, a quantity of the very finest passed through, which was made into samples; the cement passing through the sieve during the following two minutes was rejected, the sifting being continued until sufficient cement to make four samples had passed, leaving, however, a large portion still in the sieve. The adhesive strength of the former samples was much greater than that of the latter when tested after seven days' immersion. This was repeated, using the cement of other manufacturers, with the same result.

2. That so far as concerns a twenty-eight days' test, the cement of different manufacturers varied in the cementitious strength of the particles stopped by No. 176 sieve, from nothing to 20 lbs. per square inch, their strength increasing but slowly in the longer periods, and probably becoming soon exhausted.

TABLE II.—ADHESIVE STRENGTH OF THE COARSE PARTICLES OF PORTLAND CEMENT.

AGE.	Average strength in lbs. per square inch.	Degree of pulverization.
7 days....	1	Stopped by No. 176 sieve and washed.
7 "	0	54 per cent. of fine particles removed by washing only.
7 " ...	6	Fine removed by No. 176 sieve; very coarse by No. 54 sieve.
8 "	8	Particles which passed No. 176 sieve, after very fine had been removed by ten minutes' sifting.
8 "	0	Stopped by No. 176 sieve and washed.
8 "	6	Fine removed by No. 158 sieve; very coarse by No. 54 sieve.
9 "	0	Stopped by No. 103 sieve.
9 " ...	½	Stopped by No. 176 sieve and washed.
28 "	12	Particles which passed No. 176 sieve, after 46 per cent. of fine had been sifted out.
28 "	14	Fine removed by No. 176 sieve; very coarse by No. 54 sieve.
28 "	5	Stopped by No. 176 sieve.
28 "	18	" " "
28 "	20	Fine removed by No. 176 sieve; coarse by No. 103 sieve.
28 "	1	Fine removed by No. 103 sieve; very coarse by No. 54 sieve, and washed.
28 "	9	Stopped by No. 176 sieve, and washed.
28 " ...	14	Fine removed by No. 158 sieve; very coarse by No. 54 sieve.
28 "	18	Fine removed by No. 176 sieve; very coarse by No. 54 sieve, and washed.
28 "	0	Fine removed by No. 176 sieve; coarse by No. 103 sieve.
28 " ...	2	Fine removed by No. 176 sieve; coarse by No. 103 sieve.
28 " .. .	3½	Stopped by No. 176 sieve, and washed.
28 "	24	Passed No. 176 sieve, after very fine had been removed by sifting for two minutes.
15 weeks .	20	Fine removed by No. 176 sieve; very coarse by No. 54 sieve.
15 " ...	14	Stopped by No. 176 sieve, and washed.

Number of tests, eighty. Test pieces, sawn limestone,

No. 176 and No. 103 sieves were of silk, the meshes being respectively about 0.0040 inch and 0.0075 inch square, and slightly smaller than those of the same numbers formed of wire. The author has since, through the courtesy of Dr. Michaelis, of Berlin, been furnished with a woven brass wire sieve, of almost the same fineness as No. 176 silk sieve. The time required to sift 400 grains weight, using a sieve about 4 inches in diameter, varied from fifteen to twenty minutes, the operation being facilitated by the addition of a few small round pebbles.

If any general conclusion can be drawn from the table, which represents only eighty tests, it would appear to be that the cementing energy of coarse particles develops much more slowly than that of the fine particles. The necessity of adopting a high standard of pulverization is also shown. For example, the particles which were sufficiently fine to pass a sieve of ten thousand six hundred meshes to the square inch, viz., No. 103, possessed less than one-fifth of the cementitious value of those passing a sieve of thirty-one thousand meshes per square inch, viz., No. 176.

The adoption of a high standard of pulverization need cause no apprehension to manufacturers, as the percentage of cement stopped by a standard sieve, and the price, can be mutually accommodated to meet all the commercial exigencies of the case.

The degree of pulverization of the cement supplied by some of the principal manufacturers fluctuates between comparatively narrow limits, as may seen from the following table:

TABLE III.

Maker.	Percentage by weight stopped by a No. 176 sieve.	Maker.	Percentage by weight stopped by a No. 176 sieve.
F	49	L	49
D	47	S (quick setting)	41
G	45		
G	46		
H	43	S (slow setting)	47
I	47	Y	38
K	50		
		General average	45·6

A slight modification only is required to adapt ordinary specifications of cement to the terms proposed by the author.

The next point requiring investigation is the adhesive or cementitious strength of the fine particles. For this purpose the finest sieve obtainable, viz., No. 176, was used, and the cement sifted until an inappreciable amount escaped through the meshes.

In the two following tables will be found some of the principal results obtained from cements of ten different manufacturers, requiring from forty minutes to five hours to set in air. Extremely quick and very slow-setting cements were reserved for Table XII.

TABLE IV.—ADHESIVE STRENGTH of FINE CEMENT SIFTED THROUGH No. 176 SIEVE. Age, seven days. Test-pieces, sawn limestone.

Manufacturer.....	A	B	B	C	D	D	E	B	C
Cementitious stren'th in lbs. per square inch.....	61	101	101	69	73	91	85	100	84

Manufacturer.....	A	F	G	A	H	I	K	F	G
Cementitious stren'th in lbs. per square inch.....	70	57	65	74	63	83	66	81	82

Number of tests, sixty-two. General average, 78 lbs. per square inch.

TABLE V.—ADHESIVE STRENGTH of FINE CEMENT SIFTED THROUGH No. 176 SIEVE. Age twenty-eight days. Test-pieces, sawn limestone.

Manufacturer....	H	C	D	I	B	H	F	L	L	K
Cementitious strength in lbs. per square inch	71	121	66	84	110	100	77	88	109	105

Number of tests, thirty-eight. General average, 93 lbs. per square inch.

Considerable differences are apparent, not only in the cements of different manufacturers, but also in different cargoes from the same maker, and occasionally in the same cargo. Most of the tests relating to longer periods were unreliable from exposure of the samples to frost; a limited number which escaped exposure to frost had an average adhesive strength of 116 lbs. per square inch after thirteen weeks' immersion, while others of a different manufacturer, which had been in water for six months, had a strength of 113 lbs. per square inch. A set of samples, which had been some months immersed before being frozen, and therefore better able to resist injury from this cause, had an average cementitious strength, after fifteen months, of 173 lbs. per square inch, one of the samples exhibiting the highest development of adhesive strength which the author has yet observed, namely, 240 lbs. per square inch. The weight of fine cement from which this cementitious energy was developed did not exceed 5 grains. This strength is equivalent to nearly 16 tons per square foot; but few, if any, masonry-joints are ever subjected to a tearing strain of this severity.

Owing to the author preferring to make all the tests himself, and to the limited time at his disposal, the averages represented by each of the figures in the tables have been derived from three to six tests. In ordinary testing, however, it would be desirable to take the averages from not less than six tests.

Although the test proposed to be applied, after removing the inert particles by an extremely fine sieve, will probably give the most trustworthy and uniform results, the adhesive test should be also applied to the cement as received from the contractor, and as actually used in construction, this test alone being almost sufficient to enable a correct estimate to be formed of the value of the cement.

In the following tests of the cementitious strength of ordinary cement the extremes of quick and slow setting were avoided. In every case, unless otherwise stated, the cement was immersed in fresh water immediately after the test-pieces were joined:

TABLE VI.—ADHESIVE STRENGTH of ORDINARY CEMENT, AS RECEIVED FROM THE MANUFACTURERS. Age, seven days. Test-pieces, sawn limestone.

Manufacturer.....	G	K	I	F	F_1	G_1	G_2	H
Cementitious strength in lbs. per square inch.	76	57	61	69	71	73	59	56

Manufacturer.....	G_3	W	F_2	W_1	W_2	G	F_3	K_2
Cementitious strength in lbs. per square inch.	52	50	54	59	41	37	51	56

Number of tests, sixty. General average, 57 lbs. per square inch.

The cements of well-known makers were used, and with one or two exceptions the results are tolerably uniform, considering that nearly 50 per cent. of the material tested was practically inert, and its position relative to the surfaces of the test-pieces uncertain, The highest and lowest figures in the table were obtained from the same cement; it was however the slowest in setting, and nearly twelve months elapsed between the two tests. The test pieces should in every case be scrupulously clean, and allowed to remain in water for a short time before using.

Table VII. shows some of the principal results obtained from a twenty-eight-day test of ordinary cement.

TABLE VII.—ADHESIVE STRENGTH OF ORDINARY CEMENT AS RECEIVED FROM THE MANUFACTURER. Age, twenty-eight day. Test-pieces, sawn limestone.

Manufacturer.....	H	H_2	K	K_1	F	F_1	W	W_2	G	G_1
Cementitious strength in lbs. per square inch	78	57	48	71	98	68	91	84	108	75

Number of tests, thirty-six. General average, 78 lbs. per square inch.

Estimated by their cohesive strength the cements were all of good quality. The differences are not so great as those in the preceding table, and no doubt can be partly accounted for in the same way. Of course the cements of different makers could not be expected to show perfectly uniform results, but the averages would probably be only slightly altered if obtained from a larger number of tests.

Table VIII. shows the results of a limited number of tests after thirteen weeks' immersion of the samples.

TABLE VIII.—ADHESIVE STRENGTH of ORDINARY CEMENT, AS RECEIVED FROM THE MANUFACTURER. Age of samples, thirteen weeks

Average Strength in lbs. per Square Inch.	Remarks.
110	Test-pieces, sawn limestone. Samples made with and immersed in sea-water.
113	Test-pieces, ground plate glass. Fresh water.
60	Test-pieces, sawn limestone. Fresh water.
110	Test-pieces, sawn limestone. Fresh water.

Average, 98 lbs. per square inch.

A series of samples which have been immersed for seven months had an average strength of 128 lbs. per square inch. Another set which had been frozen, had a strength after twelve months of only 40 lbs. per square inch, while some samples of the same cement, but with the coarse particles removed by a No. 176 sieve, although similarly frozen and of same age, had an average strength of 107 lbs. per square inch. The comparative cementitious strength of the sifted and unsifted cements tested by the author is given in Table IX.:

TABLE IX.—COMPARATIVE CEMENTITIOUS STRENGTH of SIFTED AND UNSIFTED CEMENT.

Description.	Average in lbs. per Square Inch		
	Age, Seven Days.	Age, Twenty-eight Days.	Age, Thirteen Weeks.
Cement with the coarse particles removed by No. 176 sieve	78	93	116
Ordinary cement as received from the manufacturer	57	78	98

These results are satisfactory, particularly with reference to their bearing on the subject of the deposition of concrete, or rubble-in-concrete, in deep water, a method of construction which can be applied with such economy and rapidity of execution as to supersede the slow and costly methods which involve the use of coffer dams or large blocks. The adhesive strength shown by the author's experi-

ments indicates the great stability and monolithic character of structures in which Portland cement is employed as the cementing material, and immersed before setting. In several instances when the test-pieces consisted of comparatively soft but otherwise sound stone, such as Portland and sandstone, the adhesive strength of the cement was sufficient to tear small fragments out of the surface of the test-pieces, the age of the samples being only twenty-eight days, and the breaking-strain slightly below the average of ordinary unsifted cement (Table XV.)

In drawing any inferences from Table IX. it should not be forgotten that to produce the strength shown in the second line of figures involved the use of at least four times the quantity of cementing material required to produce the superior strength shown by the figures in the first line, or those referring to the sifted cement, owing to the difference in the thickness of joint caused by the presence of the coarser particles. The averages given above are derived from tests applied at various times to the cements of twelve different makers. An abstract of some of the principal tests applied to the same cement, or that made by one of the manufacturers, is given in Table X:

TABLE X.—ABSTRACTS OF PRINCIPAL TESTS APPLIED TO THE SAME CEMENT. Test-pieces, sawn limestone.

Age.	Average adhesive strength in lbs. per square inch.	Remarks.
1 day....	15	Ordinary cement.
3 days...	36	" "
7 " ...	76	" "
7 " ...	73	" " second set of samples.
7 " ...	91	Fine only, separated with No. 176 sieve.
7 " ...	63	Fine, with 25 per cent. of coarse added.
7 " ...	26	Fine, with 75 per cent of coarse added.
7 " ...	8	The coarsest particles that passed through No 176 sieve.
7 " ...	0	Stopped by No. 176 sieve.
7 " ...	1	" " " " " another set of samples.
28 " ...	88	Ordinary cement.
28 " ...	84	" " gauged with and immersed in sea water.
28 " ...	110	Ordinary cement gauged with and exposed to air and sea-water each alternate day.
15 weeks.	20	Fine removed by No. 176 sieve, very coarse by No. 54 sieve.
15	14	Stopped by No. 176 sieve and washed.

Average strength of cohesion of the ordinary cement as supplied after seven days, 480 lbs. per square inch. Pulverization, 45 per cent. of the ordinary cement stopped by No. 176 sieve.

The relation, if any, between the cohesive and adhesive, or cementitious, strength of neat cement seems to be extremely obscure, as might be anticipated from the fact that the presence of coarse paticles within certain limits increase the former but diminishes the latter. The following examples will serve to show that the ordinary seven-days' test of tensile or cohesive strength is unreliable as an exponent of the cementitious value:

TABLE XI.—COMPARISON OF ADHESIVE AND COHESIVE STRENGTH.

No.	Description.	Average strength in lbs. per square inch. Adhesive.	Cohesive.
1.	Ordinary cement, age seven days.....	59	532
2.	" " " "	51	336
3.	Fine cement sifted through No. 176 sieve, age seven days	94	428
4.	Fine cement sifted through No. 176 sieve, age seven days.....	57	345
5.	Fine cement sifted through No. 176 sieve age seven days.....	65	500
6.	Fine cement sifted through No. 176 sieve age twenty-eight days	105	500
7.	Fine cement sifted through No. 176 sieve, age twenty-eight days...	109	387
8.	Fine cement sifted through No. 176 sieve, age twenty-eight days.	84	428
9.	Fine cement sifted through No. 176 sieve, age twenty-eight days.....	110	309
10.	Fine cement sifted through No. 176 sieve, age twenty-eight days.....	85	320

The author believes that the cohesive test has not unfrequently led to the rejection or condemnation of excellent cement. For example, in experiment No. 9, Table XI., the low tensile strength of the cement would probably have caused its rejection, while its cementitious strength was considerably above the average of good cements.

The next point requiring investigation is the effect of quick and slow-setting on the adhesive strength, which is capable of being developed within the limits of the time available for ordinary testing purposes. Whether the time occupied in setting affects the ultimate strength of adhesion or otherwise must be reserved for future investigation.

Table XII. contains some of the author's experiments relative to this part of the subject.

TABLE XII.—ADHESIVE STRENGTH of QUICK and SLOW-SETTING CEMENT. Test-pieces, sawn limestone.

No.	Degree of pulverisation.	Age.	Time setting in air.	Average strength in lbs. per square inch.	Remarks.
1.	Ordinary	7 days	40 mins.	57	As received from makers.
"	"	7 "	8 hours	29	Cooled by air-slacking.
2.	Fine	7 "	10 mins.	58	As received from makers.
"	"	7 "	5 hours	85	As received from makers.
3.	"	7 "	40 mins.	101	As received from makers.
"	"	7 "	3 hours	41	Cooled by exposure to air
4.	Ordinary	7 "	1½ "	46	As received from makers.
"	"	7 "	3¼ "	33	As received from makers.
5.	"	28 "	40 mins.	71	As received from makers.
"	"	28 "	24 hours	48	Cooled by exposure to air.
6.	Fine	28 "	10 mins.	67	As received from makers.
"	"	28 "	5 hours	121	As received from makers.
7.	"	13 weeks	30 mins.	110	As received from makers.
"	"	13 "	14 hours	71	Cooled by exposure to air.
8.	"	6 m'ths	30 mins.	113	As received from makers.
"	"	6 "	14 hours	91	Cooled by exposure to air.

NOTE.—"Fine" cement was that which passed No. 176 sieve.

It will be noticed that, with one or two exceptions, the quick-setting cement manifested a greater development of adhesive strength than the slow, while in the case of cohesive strength quick-setting seems generally to produce an opposite effect. In experiments 1, 3, 5, 7 and 8, slow-setting was produced by air-slaking. In Nos. 2, 4, and 6, the cements used were sent by different manufacturers as samples of quick and slow-setting cement, and were not exposed to atmospheric influence.

The time of setting was arrived at by the following means: A vertical steel needle moving freely in guides, and having a flat point $\frac{1}{8}$ inch in diameter, was loaded so as to weigh 1 lb. When the pressure of the point made no visible mark on the surface of the gauged cement it was considered to be set. This is approximately the same pressure as that of the finger-nail, but it has the advantage of being more definite and reliable. Nos. 7 and 8 were samples of the same cement, and tend to show that, although the cementitious strength of the slow-setting samples developed slowly in the shorter interval; it subsequently appearred to gain on that of the quick-setting. In the examples referred to, the quick-setting gained only 3 lbs. in the second three months, while the slow-setting increased 20 lbs. in the same period. Experiment No. 2 was an extreme case, the cement showing incipient signs of hardening before the gauging was completed. The proportion of water used in gauging was limited to that required in each case to bring the cement to the same consistency.

The effect of very rapid setting is apparent in the case of orchard or quick-setting Medina, some samples of this cement showing an average adhesive strength of only 10 lbs. per square inch after seven days' immersion. Similarly, plaster of Paris had a strength of 12 lbs. per square inch after twenty-eight days in air, and Keene's cement 18 lbs. per square inch after seven weeks in air.

As regards a seven or twenty-eight days' standard test, quick-setting Portland cement can be dealt with either by providing that it shall bear a somewhat higher strain, or by bringing the time in setting within defined limits by air-slacking; the former might possibly lead to complication, the latter is apparently more likely to meet the requirements of the case. The probability is, however, that if a carefully fixed standard of cementitious strength were generally adopted, neither of the alternatives mentioned would have to be resorted to, manufacturers finding it to be their interest to produce cement of sufficient uniformity as regards setting, and fit for immediate use.

In connection with this part of the subject, the proportion of water used in gauging requires consideration. As in the author's system of testing so small a quantity of cement is gauged, he at first used a glass dropping-tube, furnished with a small flexible tube and pinch-cock, the weight of the drop, being previously ascertained; the weight of cement to be gauged was generally 200 grains. However, the proportion of water that would enable the cement to be spread easily and uniformly on the test-pieces varied slightly with almost every sample, and the fine-sifted cement required more water than the same cement unsifted. The weighing of water was therefore abandoned as introducing complications and refinements unsuitable to the practical requirements of a standard test. In all the tests recorded in this paper (unless otherwise specified) the cements were gauged to approximately the same degree of consistency, an operation which involves but little skill or experience. The test-pieces were also immersed in water previous to making the samples, and the cement was applied while the surfaces were wet.

It was noticeable, in the case of the longer testing-periods, that after fracture the cemented surfaces of the test-pieces, and the thin wafer of cement between them, were quite dry; and in the case of wrought iron the surfaces were clean and bright, exhibiting no signs of oxidation; these and other considerations would lead to the conclusion that after taking the necessary quantity of water into combination, the cement resists all further absorption.

The length of time of setting in air is complicated by the effect produced upon it by heat and humidity; four samples of the same cement were gauged with the same proportion of water, two of them being placed in rather warm, dry air, the others in cool and somewhat damp air, when the former set in twenty-seven minutes, the latter in four hours the needle test being used in each case.

Such interferences are avoided in the author's system, by immersing the test pieces immediately after the samples are made.

There appears to be considerable difference in the hardening produced in air and water in the same time; for example, one cement of good quality was gauged in the usual manner, part being replaced in air and part in water; the former set in three hours. On examining the samples eighteen hours after gauging, the testing-needle, when loaded with 2¼ lbs., produced a visible mark on the sample immersed in water, but required to be loaded with 14½ lbs. to produce a similar impression on the sample which had remained in air. As hydraulicity is the most important feature in Portland cement, if it should become necessary to take the time of setting into account, it would perhaps be more consistent and useful to note that time with respect to water rather than air.

Table XIII. contains some of the author's observations of the relative time occupied by cement in setting in air and water, ascertained by the test-needle before referred to.

TABLE XIII.—RELATIVE TIME OCCUPIED BY CEMENT IN SETTING IN AIR AND FRESH WATER.

No.	Temperature. Fahr.	Time required to set in air.	Time required to set in water.	Remarks.
	°	H. M.	H. M.	
1.	41	1 35	3 30	Ordinary cement.
2.	41	3 15	4 30	" "
3.	50	0 35	2 30	Ordinary cement, gauged very dry.
4.	50	1 40	2 45	Ordinary cement; gauged very wet.
5.	50	0 23	0 55	Sifted through No. 176 sieve.
6.	53	0 30	1 15	Sifted through No. 176 sieve; gauged rather dry.
7.	54	0 9	0 20	Special quick-setting.
8.	53	5 0	22 0	Special slow-setting.
9.	55	0 20	2 0	Ordinary cement.
10.	34	3 0	16 0	" "
Average..		1 38	5 34	

No. 5 similar cement to Nos. 3 and 4, but sifted.
No. 6 similar cement to No. 2, but sifted.

Nos. 1 and 7 were sent by the manufacturers as samples of their quick setting cement. Nos. 2 and 8 of their slow-setting; Nos. 3 and 4 were from the same cement, but gauged with a minimum and maximum amount of water respectively.

The only inferences that can be drawn from these experiments appear to be that fine-sifted cement sets faster, both in air and water, than ordinary cement, and that no definite relation exists between the respective times required to set in air and water. To insure accuracy in the above results involved much time and trouble, and it would be advisable to eliminate such observations from any universally adopted tests.

The influence of water in gauging, on the cementitious strength, is somewhat capricious; an excess of water frequently produces an increase of strength compared with cement gauged very dry. Sometimes, however, the samples possessed the same strength in both cases, the samples being, in every instance, immersed as soon as they were made.

The strength of adhesion of Portland cement to different substances varied considerably; the roughness or smoothness of the cemented surfaces, however, did not affect the strength as much as had been supposed.

Table XIV. contains most of the results ob-

tained by the author relative to this part of the subject.

TABLE XIV.—STRENGTH OF ADHESION OF PORTLAND CEMENT TO VARIOUS MATERIAL.

MATERIAL.	AVERAGE ADHESIVE STRENGTH. 7 days.	28 days.	13 weeks.	6 months.	REMARKS.
Bridgewater brick.	19	..	....	...	Ordinary cement.
" "	24	66	....	...	Sifted through No. 176 sieve.
Slate (sawn).....	49	....	....	...	Ordinary cement.
" "	53	82	....	62	Sifted through No. 176 sieve.
Portland stone....	26	50	...	.....	Ordinary; fragments torn out of surface.
" "	29	62	....	55	Sifted through No. 176 sieve; fragments torn out of surface.
Ground plate glass		102	113	....	Ordinary cement
" " "	...	....	145	....	Sifted through No. 176 sieve.
Plate iron.....	23	68	....	....	Ordinary.
" "	44	66	....	....	Sifted through No. 176 sieve.
Sandstone...	.....	49	....	...	Ordinary; fragment torn out of surface.
Polished marble...	38	..	....	.....	Ordinary cement.
" " ...	52	71	....	75	Sifted through No. 176 sieve
" plate glass	47	40	70	....	Ordinary cement.
" " "	55	49	51	....	Sifted through No. 176 sieve.
Granite (chiseled)..	41	....	....	....	Ordinary.
" "	78	97	153	...	Sifted through No. 176 sieve.
Limestone (sawn).	57	78	98	....	Ordinary cement.
" "	78	93	116	....	Sifted through No. 176 sieve.

Total number of tests (omitting those of sawn limestone), one hundred and eighty-two.

The best Portland cement, obtained from five leading manufacturers, was used in the course of these experiments.

The cement adhered to very hard surfaces, such as granite and ground plate glass, with much greater strength than to softer material, as Bridgewater brick, Portland limestone.

The strength of adhesion to polished surfaces was also remarkable; in the case of polished plate glass the average adhesive strength of fine cement in one set of samples was, after 12 months' immersion, 125 lbs. per square inch; the surfaces of the thin wafer of sifted cement joining the test-pieces, particularly in the longer periods, possessing the same fine polish as the glass, so much so as to suggest the use of polished cement for ornamental purposes. Some experiments made with oak, both in air and water, showed so small an amount of adhesion as to be hardly appreciable.

In comparing the results obtained from ordinary cement and that sifted through No. 176 sieve, the relative quantities of the cementing material, and other considerations referred to, should be borne in mind. Some experiments were made in which the cement was gauged with, and immersed in, sea-water, to compare with others made at the same time, in which fresh water was used.

The results were as often favorable to one as the other, the averages being almost identical; the number of tests, however, was but forty, and the time from one week to five weeks. A few tests were also made to try the effect on ordinary cement of breaking the bond; the results showed an average strength of 8 lbs. and 32 lbs. per square inch, after seven days and thirteen weeks respectively, the bond being broken (*i. e.*, the test-pieces disconnected and then replaced in position) twenty-four hours after the samples were made, but the limited number of experiments considerably diminish the value of these results.

The most suitable shape for the test-pieces had to be determined by experience, involving repeated trials; the first shape selected was that ultimately adopted, namely, cruciform. It was, however, discarded at first, owing to the want of a suitable testing machine. In the preliminary experiments a slab of stone was introduced into the neck of the ordinary cohesive sample, an arrangement which, unknown to the author, had been adopted by Dr. Michaëlis about the same time. This was found cumbersome and tedious; it was also difficult to insure perfect contact between the stone and cement, and it almost precluded any lengthened series of tests with the fine and coarse particles of cement, owing to the time required to sift so large a quantity as would be necessary. Cubes of stone with holes drilled in the side to receive suitable clips were next tried, but they were also cumbersome and expensive, and the results likely to be unsatisfactory. The majority of experiments referred to in this paper were made with test-pieces, one of which was 2 in. by 2 in. by $\frac{3}{4}$ in., having a hole rather less than $\frac{3}{4}$ in. in diameter drilled through the center, the other being $1\frac{1}{16}$ in. by $1\frac{1}{16}$ in. by $\frac{3}{4}$ in. So that, deducting the area of the hole, the cemented surfaces had an area of 1 square inch. The cement was placed on the smaller piece, which was then fixed centrally on the larger, and a slight pressure used to insure perfect contact; a steel pin, fitting the hole loosely, afforded the means of applying the force necessary to separate the test-pieces. This arrangement works satisfactorily, but involves a little trouble in removing the superfluous cement pressed out from between the test-pieces into the hole in the under one, and which, if not removed before testing, might possibly cause the end of the steel pin to be wedged,

To render such a contingency impossible, the cruciform shape was adopted, and the author believes it will be found to meet all the requirements for accurate testing. The testing-machine already described permits the use of either drilled or cruciform test-pieces. The neatness, accuracy and facility with which tests can be made by the author's method, he ventures to think, will be appreciated by those who have had experience in testing cement by its cohesive strength, either neat or mixed with sand.

The advantages of a universal test, recognized alike by manufacturers and consumers, can hardly be overrated. At present manufacturers are considerably perplexed and inconvenienced by the varying conditions imposed by engineers and others, but would be willing to work to a carefully-arranged practical standard, if such were agreed upon.

The total number of adhesive tests made by the author has exceeded 1,200, a number which, however, must be considered somewhat limited when the nature, properties and uses of the material are taken into account.

In adopting the adhesive test the usual specification of the quality of English Portland cement requires to be modified to the following effect:

"The cement shall be ground so that not more than 45 per cent. shall be stopped by a No. 176 silk sieve, and its average adhesive strength after 28 days' immersion shall be as follows:

"Cement passing No. 176 sieve not less than 95 lbs. per square inch.

"Cement as supplied for use not less than 75 lbs. per square inch.

Six tests being employed in each case."

If desired, a seven-days' test can also be specified. Such a modification will involve but little extra trouble to manufacturers, some of whom now produce cement of considerably finer pulverization than that above indicated.

With reference to a standard test, the author's investigations and remarks may be briefly summarized as follows:

That the cementitious or true value of Portland cement can be best determined by testing its adhesive strength.

That the degree of pulverization is probably the only other condition, the practical importance of which will warrant an introduction into a standard system, which should therefore include a standard sieve. That a sieve having one hundred and seventy-six meshes to the lineal inch will be found sufficient for all practical purposes.

That so far as regards the limited time which can be allowed in practice for testing before use, an estimate of the quality of cement can be best obtained by testing the cementitious strength of the fine particles capable of developing most of their strength within the period referred to, but that this should not prevent an adhesive test from being applied to the cement in its ordinary condition.

That any complications arising from differences in the adhesive strength produced by quick and slow setting should, if possible, be eliminated from a standard system of testing. With respect to the time to be allowed for testing, the author believes that the recognized periods of seven and twenty-eight days can be made sufficient, and should be retained, longer periods being desirable, but precluded by the practical inconvenience involved. If the seven days' test was satisfactory, and necessity should arise, the cement could be used without further delay; but, as a rule, judgment should be reserved until after the result of the twenty-eight days' test was known. As regards what has been called the "weight test," the author believes it might with advantage be omitted, but, if desired, the density could be ascertained in the manner described by the author in a former paper.*

AMERICAN COTTAGES is the title of the latest architectural publication of Wm. T. Comsock, 6 Astor Place, New York. The book is exceedingly tasteful in appearance, and contains forty-four large quarto plates, giving original designs for medium and low-cost cottages, seaside and country houses. Many of the drawings are the work of prominent architects, and the designs range in cost from $800 to $3,000. With most of the designs all essential details are given, and in one case at least the full specifications.

The work must be acceptable to those who contemplate building, as presenting a variety of plans from which to select. For price apply to publisher.

* Minutes of Proceeding Inst. C. E., vol. xlvii., p. 251.

A NEW TELESCOPE COMPASS.

Surveyor's have long felt the want of an instrument more accurate than the sight compass and as portable in character, and to meet this want several ways were devised of attaching a telescope to the compass, most of them being detachable, that is, they were taken off the instrument when packed in its case, and put on again when in use.

Among the many objections to this plan, the principle one is the disarranging of the adjust-

FIG. 1.

ments, and it is due to this fact that they have been found wanting and generally discarded after a few trials.

Mr. Blattner's improvement overcomes these objections, for without detaching the telescope it is placed in such a position that a Vernier Transit of this new construction requires a case three inches shorter, one inch less deep than a sight compass of same size needle, without in the least disturbing the adjustments.

Fig. 1 represents this Vernier Transit as when in use, Fig. 2 as when packed in its case.

By referring to the illustrations it will be seen that the telescope has two standards and an axis

FIG. 2.

similar to the most costly and complete Engineer's transit, this is necessary to secure accuracy and permanent adjustment. The standards are fastened to the main plate by journals and their bearings, permitting the standards when not clamped to move either up or down, and the telescope to take the position as shown in Fig. 2. If the standards and telescope are again brought to the upright position and clamped as when in use, the adjustments will not have been disturbed. The journals are made very strong, holding the standards very firmly.

These improvements are patented by Mr. H. Blattner, of the firm of Blattner & Adam, St. Louis, and are manufactured by them.

NORFOLK SEWERAGE.

WILKESBARRE, Pa., May 14, 1883.

EDITOR ENGINEERING NEWS:

In your issue of the 5th inst., article Sewerage of Norfolk, Va., see formula for size of pipes, where m = cubic feet per second, by which we obtain for a pipe 1,500 feet long on a grade of 0.5 per 100 (all other conditions being as stated in the article) less than $\frac{1}{32}$ of an inch for the diameter of the pipe required.

But, taking m = cubic feet per minute, instead of per second, we get over $5\frac{3}{4}$ inches for the diameter of the pipe required; nearly the theoretical size. C. F. J.

THE DAKOTA CAPITOL COMPETITION.—Proposals were received from ten towns of the Territory, as follows: Aberdeen, $100,000 and 160 acres of land; Redfield, $100,000 and 240 acres; Pierre, $100,000 and 160 acres; Bismarck, $100,000 and 320 acres; Mitchell, $160,000 and 160 acres; Ordway, $100,320 for the Capitol and 100 acres of land for a depot; Canton, $100,000 and 160 acres; Frankfort, $100,000 and 160 acres; Huron, $100,000 and 160 acres; Odessa, $200,000 and 160 acres; Steele, $100,000 and 160 acres. An informal bid from Wessington was received, and a bid of $1,000,000 from Sioux City, Iowa.

ENGINEERING NEWS
AND
AMERICAN CONTRACT JOURNAL.

Tribune Building, New York City.

The Engineering News Publishing Company, Proprietor.

Published Every Saturday.

CONDUCTED BY

GEO. H. FROST and D. McN. STAUFFER.

TERMS OF SUBSCRIPTION:

$4.00.....PER YEAR TO U. S. AND CANADA.
$5.00 ..... " " " FOREIGN COUNTRIES.

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NOTICES OF MEETINGS.

AMERICAN SOCIETY OF CIVIL ENGINEERS—ANNUAL CONVENTION OF 1883.

The annual convention of the Society, for the year 1883, will be held at St. Paul and Minneapolis, Minn., beginning June 19th, 1883. Sessions for professional discussion and one for the transaction of business will be held.

The preliminary arrangements have been made by D. J Whittemore, Esq., M. Am. Soc. C. E., in consultation with the Board of Direction and with a number of gentlemen in the North West.

They are being perfected by a joint committee appointed from the two cities, viz:

ST. PAUL.—J. W. Bishop, D. C. Shepard, Wm. Crooks, D. W. Ingersoll, L. W. Rundlett, Howard Elmer, W. A. Van Slyke, J. B. Hoxsie, L. A. Gilbert.

MINNEAPOLIS.—W. S. King, C. F. Hatch, C. H. Prior, G. A. Brackett, W. D. Washburn, R. B. Langdon, A. C. Rand, C. A. Pillsbury, O. A. Pray.

It is already arranged that the ordinary meetings shall be held at St. Paul, June 19th, 20th and 21st, and that the meeting on the day on which the President's address is to be delivered, June 22d, will be held at Minneapolis. Halls for these meetings have been tendered at each city.

Visits will also be made to points of interest at and in the vicinity of St. Paul and Minneapolis. Excursions to more distant points will also be arranged.

The headquarters of the Society, except during the time of meetings, will be at the hotel Lafayette, at Lake Minnetonka, Minnetonka Beach. This hotel is but a short railway ride from either city, is very pleasantly located, is of large size and with excellent accommodations.

Arrangements have been made by the Committee for the accommodation of the visitors to the Convention and their families at this hotel at the rate of $2.50 per day. Special rates will also be made by hotels at each city.

A reception and banquet will be tendered by the citizens of St. Paul and Minneapolis at this hotel.

By the courtesy of the St. Paul, Minneapolis and Manitoba Railway, James J. Hill, Esq., President, trains will be run between the cities and the Hotel Lafayette, at hours arranged, with reference to the times of meetings, etc.

The Chicago, Milwaukee & St. Paul Railway extends an invitation to the visitors to the Convention and their ladies to pass over their lines between Chicago and St. Paul and Minneapolis, in going to and returning from the Convention. Special cards of invitation for this will be sent by the Secretary of the Society to the members who notify him that they will attend the Convention. These invitations will be good to return until Aug. 1.

Arrangements for transportion to Chicago have not yet been perfected. As favorable rates as possible will be secured and announced to those notifying the Secretary of their intention to visit the Convention.

As a number of members have expressed a desire to visit the National Exposition of Railway Appliances to be held at Chicago, arrangements have been made to establish a headquarters of the Society at Chicago, during the week previous to the Convention (the week beginning June 11). The office of the Secretary of the Society during that week will be at the Leland Hotel, fronting upon the lake, and opposite the buildings of the Exposition. The visitors connected with our Society will be accommodated at that hotel at from $3.00 to $3.50 per day. Should the number be large, arrangements have also been made with the Matteson House in the immediate vicinity, for additional accommodations at from $2.50 to $3.00 per day.

The Society Committee on the Preservation of Timber will present an exhibit at the Chicago Exposition.

The Western Society of Engineers will extend courtesies during our visit at Chicago, and through a Committee, will arrange for an excusion to points of Engineering interest, including probably a visit to Pullman. A day will be set apart for this, probably toward the end of the week previous to the Convention.

The Chicago, Milwaukee and St. Paul Railway tender a special train to run from Chicago to St. Paul by daylight, should a sufficient number announce their intention in advance to accept this kindness. This train will leave the Madison Street depot of that railway in Chicago, at 7.30 A. M., of Monday, June 18th, and to warrant acceptance of this offer, and to enable the officers of that Railway to make proper arrangements the members of the Society should *notify the Secretary at as early a time as possible that they will be present at the time appointed.*

It will be seen that members may arrive at Chicago at any time during the week previous to the Convention week, but as many as possible should be present at the time appointed for leaving Chicago by special train.

Information as to papers and discussions is given in a separate circular.

The families of members are invited to accompany them to the Convention.

Herewith please find a blank form to be filled out and returned to the Secretary.

In order that suitable arrangements may be perfected for the transportation and accommodation of all, and for the arrangement of the special train, it is really necessary that the information covered by the replies to accompanying blank be received as soon as possible, and the Committees earnestly request the return of this blank filled out as suggested *at your earliest convenience.*

The probabilities seem to be that this Convention will have a very large attendance from all parts of the country.

JOHN BOGART,
Secretary, American Society of Civil Engineers.

May 10th, 1883.

The titles of papers published in Transactions since the last Convention, or in preparation for publication, and upon which discussion is invited, are given below.

Members are particularly desired to take part in discussion upon any of the subjects presented, either by these papers of the past year or by new papers. Members are also requested to present papers upon other subjects.

PAPERS PUBLISED DURING THE PAST YEAR.

CCXXXXII. (*May.*) Annual Address at Washington, May 16th, 1882; Ashbel Welch.

CCXXXVIII. (*June.*) Sub-Aqueous Under-pinning; A. G. Menocal.

CCXXXIX. (*June.*) The Mean Velocity of Streams Flowing in Natural Channels; Robert E. McMath.

CCXL. (*July.*) On the Determination of the Flood Discharge of Rivers and of the Back Water caused by Contractions; William R. Hutton.

———(*July*) Discussion of above Paper; Theodore G. Ellis, R. E. McMath and W. R Hutton.

CCXLI. (*July.*) Accuracy of Measuremont as Increased by Repetition; Stephen S. Haight.

CCXLII. (*August.*) The Overflow of the Mississippi River; Lyman Bridges.

——— (*August.*) Discussion of above Paper; E. L. Corthell, J. A. Ockerson and Lyman Bridges.

CCXLIII. (*August.*) Highway Bridges: James Owen.

———(*August.*) Discussion on this subject; Ashbel Welch.

CCLV. Discussions upon the above subject: The increased Efficiency of Railways for the Transportation of Freight, published in Transactions for *April*, 1883.

CCXLIX. (*November*). Rapid Methods in Topographical Surveying: Wm. Bell Dawson.

———(*December.*) Discussion on this subject: James P. Allen.

CCL. (*December*). Weights and Measures: Fred. Brooks.

———(*December.*) Discussion on this subject: Jacob M. Clark.

CCLI. (*December.*) On the Care and Maintenance of Bridges: Henry D. Blunden.

———(*December.*) Discussion on this subject; Theodore Cooper.

CCXLIV. (*September.*) Uniformity in Railway Rolling Stock: O. Chanute.

CCXLV. (*September.*) The Hudson River Tunnel: Wm. Sooy Smith.

——— (*September*) Discussion on this subject: Wm. H. Paine.

CCXLVI. (*October.*) Preservation of Timber: Preliminary Report and Papers accompanying the Report of the Committee on this subject: O. Chanute, Chairman.

CCXLVII. (*October.*) The Kyan Process for Preservation of Timber; its use and effect at Fort Ontario, N. Y.; Wm. P. Judson.

———(*October.*) Discussion on the Preservation of Timber; Mendes Cohen, A. Gottlieb, T. Egleston, James B. Francis and Clemens Herschel.

CCXLVIII. (*November.*) On the Increased Efficiency ot Railways for the Transportation of Freight: Wm. P. Shinn.

CCLII. (*December.*) A Peculiar Phase of Metallic Behavior: O. E. Michaelis.

———(*December.*) Discussion on this subject: T. Eggleston and O. E. Michaelis.

CCLIII. (*January, February and March*, 1883.) Description of some Experiments on the Flow of Water made during the Construction of Works for Conveying the Water of Sudbury River to Boston: A. Fteley and F. P. Stearns.

CCLIV. (*April*, 1883.) The Flow of Water through Pipes: Hamilton Smith, Jr.

The following papers, not yet published, are also open for discussion. Proof slips of these will be prepared for issue as soon as possible

The Drainage of the Valley of Mexico: F. de Garay.

Geodetic Field Work: Geo. Y. Wisner.

The Proper Compensation for Railroad Curves upon Grades: W. R. Morley.

Suggestions as to the Conditions proper to be required in Highway Bridge Construction: J. A. L. Waddle.

An accident to Steam Pipes resulting from the use of Blast Furnace Wool: T. Egleston.

Reports will be expected from the Committees on Standard Time; on the Preservation of Timber; on a Uniform System for Tests of Cement, and those subjects will be discussed.

Discussion is requested upon any of the above subjects by members who cannot attend the Convention.

The Secretary will be glad to present these if forwarded to him previous to the Convention.

It is particularly requested that papers offered for presentation at the Convention be sent to the Secretary not later than June 6th, so that proper attention may be given the subjects presented.

JOHN BOGART,
Secretary Am. Soc. C. E.

May 10th, 1883.

AMERICAN INSTITUTE OF MINING ENGINEERS—ROANOKE MEETING.

Local Committee of Arrangements.

IN ROANOKE.—J. H. Bramwell, Chairman; J. H. Sykes, Secretary; Dr. F. Sorrell, Frank Maddock, Major Andrew Lewis, J. Allan Watts.

IN LYNCHBURG.—Capt. C. M. Blackford, Chairman; Jno. H. Flood, Geo. M. Jones, P. J. Otey, W. B. Robinson, T. B. Deane, C.W. Button, T. D. Davis, H. Grey Latham, Alex. McDonald, L. S. Marye, John Stevenson, Jr.

PROGRAMME.

Monday, June 4.—The opening session will be held in Roanoke, on Monday evening at 8 o'clock. Addresses of welcome will be made by Mr. J. B. Austin and Mr. Lucien H. Cocke, Mayor of Roanoke. Reading and discussion of papers.

Tuesday, June 5.—Visit to Lynchburg by special train on the Norfolk & Western Railroad. On arrival at Lynchburg, a train, kindly provided by the Richmond & Allegheny Railroad, will take the party to the iron mines on the James River at Riverville, and, if time allows, also to Stapleton. In the afternoon a session of the Institute, for the reading and discussion of papers, will be held in the hall of the Lynchburg Chamber of Commerce. Return to Roanoke in the evening.

Wednesday, June 6.—Local excursions around Roanoke, visiting the Crozier Furnace, Upland and Houston mines, Rorer Iron Company's mines and the Roanoke Machine Works. Evening session.

Thursday, June 7.—Excursion to Pocahontas (Flat Top Coal Fields) and the Southwest Virginia Improvement Company's coal mines and coke ovens. Returning, the Ripplemead mines and Bertha Zinc Works will be visited. The night will be spent at Abingdon or Wytheville.

Friday, June 8.—Excursion to the Cranberry magnetic iron ore mines in East Tennessee, returning to Roanoke in the evening.

On returning home, via the Shenandoah Valley Railroad, members can stop at the Natural Bridge and the Caves of Luray. Those wishing to visit the Cripple Creek ore region can do so by remaining after the close of the meeting, the Norfolk and Western Railroad having kindly extended the courtesies of the road for this purpose.

The Shenandoah Valley and the Norfolk & Western railroads have generously offered free transportation to members and the ladies of their families over their lines to and from Roanoke, and also for the excursions of the meeting. Members can obtain the proper credentials for transportation from the Secretary of the Institute. Negotiations are in progress for reduced rates to Hagerstown. Md., the northern terminus of the Shenandoah Valley Railroad, and members will be duly informed if reduced rates are obtained. It is necessary that the Local Committee of Arrangements in Roanoke should know promptly how many members will attend the meetings and the number of ladies, who will be in the party. Members are therefore urgently requested to give notice to the Secretary of the Institute, as soon as possible, of their intention to be at the meeting.

The train leaving New York at 8 o'clock P. M., daily, has a through sleeping car to Roanoke, arriving at 4.25 P. M. next day. Members are advised to secure sleeping-car berths early. It is suggested that those who can spare the time will find it pleasant to arrive in Roanoke on Saturday afternoon, where excellent hotel accommodations will be found.

Any additional information which members may desire with regard to trains, etc., will be furnished by the Secretary of the Institute or the Secretary of the Local Committee at Roanoke. Time tables of the excursions will be given in the programme of the Local Committee.

R. W. HUNT, President. T. M. DROWN, Secretary.
Easton, Pa., May 8, 1883.

LIGHTING BRIDGES OVER NAVIGABLE RIVERS.—The United States Light House Board, under date of April 4, 1883, have issued a circular regulating the placing of lights on all bridges over navigable streams. Diagrams denote the color and position of the lights to be used, and cover single span, long-draw, and high and low-bridges; the centre light is *green*, the margins of channel or channel piers defined by *red* lights.

FUTURE WATER SUPPLY OF PHILADELPHIA.—Mr. Rudolph Hering, C. E., has been appointed by Col. Ludlow, Chief Engineer of the Philadelphia Water Department, to take charge of the preliminary work and surveys for determining the sources of a future water supply for the city of Philadelphia. The work will be of considerable magnitude, as the territory includes the region of the upper Delaware, the Lehigh, Perkiomen, and Schuylkill. Surveying parties will at once be sent into the field and preparations made for extensive rain-fall observations and gaugings of the various sources.

AN advertisement in the Swiss *Bau-u. Eisenbahn-Zeitung* informs the engineering world that some twenty of the engineers of the St. Gothard line are now seeking employment, that they are peculiarly skilled in tunnel and railway work and from their linguistic attainments would be serviceable in foreign countries. Unless the Simplon tunnel is soon begun it is quite within the range of probabilities that some of these gentlemen will favor the United States with their presence. There is a great deal to be done in Europe in engineering enterprises if nothing else, in providing an efficient system of embankments along the lower Rhine, and Po valleys, but men's minds seem on other thoughts intent and their purses not in venturesome mood.

WATER RATES AND STATISTICS.—The National Meter Co., of New York, deserves credit and thanks for the publication of "Water Rates and Water Statistics," just issued by it. While the work, a book of about eighty large octavo pages, is intended to especially set forth the record and merits of the meters made by this company, it also presents, in a concise form, a fund of useful information to all interested in the consumption of water. The tariff of water rates compiled from official returns from 250 cities and towns in the United States and Canada is the most complete that we have ever seen, and is particularly full in regard to meter data, as might naturally be expected from the source. A number of other tables follow, all relating to the same subject, and of in

terest to the engineer called upon to investigate the wastage of water and the remedies therefor.

A copy will be sent to any address by applying at the office of the company, 51 Chambers street, N. Y.

TESTING DYNAMITE.—The Austrian Engineers' Union are to investigate the qualities of dynamite, and report on the best method of ascertaining them. Complaints are often made about the difficulty of testing the explosive. A committee has approved the test of Director Franzl, which practically consists in having a small quantity of the explosive inserted in a piece of lead—a cylinder 20 centimetres (eight inches) in diamter, and the same in height. A canal of 12 centimetres in depth and 2½ centimetres in diameter is bored as much as possible in the centre, and the charge placed in it (usually 20 grams). From experiments made it was found that the original cavity of 58 cubic millimetres was enlarged to 1,450 by explosive gelatine; to 1,150 by dynamite No. 1; to 800 by No. 2, and to 660 cubic millimetres by new No. 3 dynamite. The cavities are measured by water from a graded glass. Very extended improvements are now to be carried on and partly under the auspices of the military authorities.

THE COMING ENGINEERS' CONVENTION.

In the present issue we print the programme of the Annual Convention of the Am. Soc. C. E., as far as the arrangements have been completed. It is expected that the attendance this year will be unusually large, and we trust that this expectation may be fully realized. Every member of the association who can possibly do so, should take part in the convention in the interest of the profession generally. The gathering should be made an imposing one in numbers and in the standing of members present, so that the public may form a better idea of the influence and importance of the profession.

Our American engineer is too prone to confine himself to a narrow sphere, to stick too closely to the immediate business on hand, and while this characteristic is commendable in its way, a little more contact with his fellow practitioners, and a more extended interchange of professional opinions and experiences, must result in good to all concerned. The purpose and chief end of these annual conventions is to, at least once a year, permit men to meet who are usually separated by many miles of travel; to give them an opportunity of once again seeing old friends and forming new acquaintances; to permit that class friction which must end in brightening up their ideas, and rubbing off accumulated rust.

PUBLIC APPRECIATION OF THE CIVIL ENGINEER.

The *London Times* in its report of the late annual dinner of the Institution of Civil Engineers, offers food for thought to the profession in the United States; titled personages in abundance figured at that feast, the Earl of Derby responded on behalf of the House of Lords, John Bright for the House of Commons, Admiral Sir A. Cooper Key, spoke for the navy, and the American Minister, J. Russell Lowell for "Our Guests."

The report shows, from the long list of men famous in literature, science and politics present on that occasion, but not actually members of the Institution, that the civil engineer is a highly appreciated member of society in England.

Contrast this public and honorable recognition of the worth of the profession, with the modest array of "outsiders," who appear at an annual convention dinner of the American Society of Civil Engineers, and the result is not flattering to our professional pride. With us it is an event comparitively unknown, and exciting little interest outside of engineering circles; and yet the men present have done quite as much for the material advancement of our country's interests, as have any of their brothers of the British institutionfor theirs.

Take any occasion of public ceremony in the UnitedStates—and this is especially the case where those who control our politics have the invitation of guests—and you will find the clergy, law, medicine, and above all, the body politic, well represented, but the engineering profession is very generally forgotten altogether. The coming opening of the Brooklyn Bridge is a direct case in point. This is an event in which above all other professions the engineer is most interested; it is a work the successful completion of which is due entirely to his technical knowledge and skill, and yet from all that we can learn, civil engineers, as a body, will be unrepresented at the approaching ceremony—no place is assigned them, no invitation extended.

Why is this apparent lack of appreciation of a class of men to whom the public owe so much? Are American engineers too modest to assert themselves? There are said to be eight thousand members of the profession in the United States; they are surely powerful enough to make themselves felt if they but would. Millions daily use the highways their skill has produced, and the evidence of their handiwork is on every side. Let us suppose, for a moment, that the nation was deprived of their services; what a stagnation would follow—a loss of commerce, a reduction of every comfort, a deprivation of many things that are now looked upon as necessities. Once again our country would revert to the condition of colonial days: mud roads for railways, a mail once a week, no telegraph, no cable, no progress. The change would indeed be a striking one; but were such a change possible, the *absence* of the engineer would perchance be felt.

It lies partly with the profession itself to correct this lack of interest and appreciation in the masses, by elevating still higher than at present the professional standard; by thoroughly sifting out the chaff so that the golden grains may appear more prominently. The title of "civil engineer," as used in many cases, is entirely too vague, and too often appears as a handle to a name utterly unworthy to bear it. A "doctor" without a diploma is soon hunted out of practice by his titled compeers, but "engineering quacks" are still permitted to risk human life, in another profession, by their ignorance of the simplest laws of construction; crumbling masonry and ruptured bridges testify at too frequent intervals to the existence of this class within the professional ranks.

This subject is a delicate one to handle, but we believe the practical solution lies in a *National* engineering society, with stringent regulations, honestly carried out, for admission to membership, and with *all* worthy members of the profession entered upon its rolls. We have an American Society of Civil Engineers it is true, but while it is the parent organization, the most powerful in numbers and the most respectable in the general standing of its members, its position as a national society is not sufficiently well established nor appreciated among American engineers. Independent associations, having less stringent regulations for admission, are too common. If there is a necessity for the existence of these separate organizations, and we believe there is such necessity, let them be chapters of one great American society, bound by the same interests, and controlled by the same standards.

Let railroad officials and all others seeking the services of the civil engineer, understand, that when they select from within the ranks of such a national association, they are guaranteed a certain amount of professional skill and experience, that their man, in other words, has a record which will bear examination; and let them understand on the other hand, that when they go outside these lines for an engineer they do so at their own risk, and are liable to obtain a practitioner who through ignorance of his duties may cost them dearly in the end. Let this status be well established, and those who are unfitted by education, training or experience for the exercise of professional duty will be driven from the field, and the name of "Civil engineer" receive more honor in the land.

In such a national association, with its requirements stringently and faithfully carried out, another matter of serious import to the engineering profession may find adjustment; that is, that as a class they are not paid in proportion to the education, long years of experience and close application required to fit the engineer for the higher walks of his profession, nor in proportion to the responsibility thrust upon them. As an example, we know of at least one of our great trunk lines which pays its chief engineer the paltry sum of $2,500 per year, and yet expects him to manage an immense property, and to serve them solely in a capacity, where he can either save or squander his salary a hundred times over in the location or revision of a few miles of road bed. If he is only worth the salary paid him, the managers of that same road are unfitted for their position, for they are not securing the professional skill the interests of their stockholders demand. If he is an engineer competent to fill all the requirements of his office, his abllity should be recognized in the compensation given him. A physician holding a like position in his profession would receive as much in a single fee for a few weeks attendance at a patient's bedside; and a politician, for services demanding the brains of the average clerk, is paid twice or four times the amount named; as a proof take any municipal pay role and contrast the salary of the engineering staff with the amounts given to those holding the purely civil positions.

The duties of an engineer are all engrossing, and if he attend strictly to the professional demands upon his time, he has little or no opportunity for engaging in any outside enterprise by which his revenue may be increased; his position is one of great responsibility, and the constant wear and tear upon brain and nerves must speedily tell; he ages fast, and it seems but simple justice, that after a life of anxious toil in the service of a corporation whose very framework he has created, his old age should be secured to him in comfort, by a proper recognition of the true value of his services. Were this the case, we would see fewer members of the profession, whose record of work done has been most brilliant, pass the evening of their useful, eventful lives in comparative poverty,

SELF-RECORDING TIDE AND RESERVOIR GAUGES.

In the course of the discussion on Sir William Thomson's paper on "The Tide Guage, Tidal Harmonic Analyzer and Tide Predicter," which was read and discussed a few months ago before the Institution of Civil Engineers, one of the members stated that "he hoped that the practical result (of the discussion) would be to make the use of the automatic tide gauges more general than it had been, because there could be no comparison between the advantages of continuous automatic observations and those which were taken even by the most careful observers;" and it was a very noticeable fact that, in marked contrast with the opinion widely held a few years ago, those who took part in the discussion, were, without exception, strong advocates of self-recorded observations. The most careful and conscientious of observers is liable to error, either in observation or in recording; and with those who are less careful or less conscientious, the liability to error is still greater, and where the opportuity occurs they are very apt at times to omit readings, and to fill in the records afterward by interpolation, without much risk of discovery. The automatic gauge is always on duty, gives a continuous record showing every phase and variation of the level of the water, at every instant of time. If an unusual or unexpected variation takes place, it is accurately shown on the curve without any doubt as to the correctness of the record. If the record is taken by a personal observer, such variations would pass unnoticed, because they would come between the regular periods of observation, or they would be so imperfectly recorded that they would probably be looked upon as errors, and of no value. The automatic gauge gives its results in the form of a curve, plotted directly and without labor, and

without the risk of error which attends the operation of plotting the curve from personally recorded observations. This curve presents all the facts in graphic form, showing at a glance the rise, fall, range, etc., of the water, and also in a form suitable for preservation, or for analytical study.

The self-recording gauge also possesses the advantage of economy over the method of personal observations. It requires only a small amount of attention, as it can be looked after by one who has other duties to perform. A superintendent, clerk, draftsman, or in the case of some of the simpler machines, an intelligent watchman, can change the sheets, wind the clock movement, and give it such other periodical attentions, daily or weekly, as it may require.

The essential parts of a self-recording gauge are the float, the tube, the cord connecting the float with the recording mechanism, and the recording mechanism. The float should be of some non-absorbing material, so as to retain a uniform weight, and just heavy enough to sink when not supported by the cord and counterweight. These conditions are fulfilled by using a cylinder of light wood, from six to nine inches in diameter, and from five to seven inches in length, entirely covered with thin sheet copper or coppered tin, well soldered so as to exclude the water ; the top and bottom edges should be slightly rounded off. A light rod of brass or copper passes through the axis of the float, with an eye in its upper end, to which the cord is attached, and hook at the lower end, to which may be attached any weights which may be necessary to overcome its flotation. The tube in which the float rises and falls should be about 1 or 2 in. larger in diameter than the float. It may be either of metal or wood. One style that is frequently used is made of a galvanized sheet iron pipe, smooth on the interior surface, and incased in a rough wooden box to protect it from indentation by floating material. The tube is generally left open at the bottom; but where there is any wave motion its effects on the float are neutralized by closing the bottom of the tube, leaving only a ⅛-in. hole, through which the water will flow rapidly enough to cause the float to keep pace with a very rapid rise and fall of the water, but not so rapidly that the float will be affected by the more rapid wave movements. The cord connecting the float with the recording mechanism should be strong, flexible and durable, and not subject to variations in its length. Various materials have been suggested and used for this purpose, of which the most prominent are platinum wire and fish line. The former to be flexible enough requires to be very fine, and it then becomes subject to kinks and consequent breakings. After several months use it appears to become brittle, and then breaks without kinking. These defects render it very unreliable. More satisfactory results are obtained by using an "oiled, braided silk fish line," size No. 3 or No. 4, which has great strength and durability, and when once set is not subject to variations in its length.

The recording mechanism should be placed directly over the float if possible. It consists of a large grooved wheel of suitable diameter, around which the cord from the float passes, and which is caused to revolve by the rising and falling of the float, the cord being counterweighted so as to give it the necessary friction on the wheel. The shaft which carries the larger wheel also carries a smaller wheel, whose diameter bears the same ratio to that of the larger wheel that the range scale of the desired curve bears to the actual range of the water level. The smaller wheel is connected with the marking carriage by suitable mechanism, so as to translate the vertical movement of the float into a movement parallel to the axis of the recording cylinder. The marking carriage carries a pen or pencil which marks the record on the paper as it passes over the recording cylinder. For producing the curve ink has been used, but with indifferent success. It either flows too freely or not freely enough; the pen becomes clogged; a sudden jar produces a blot; a wave motion produces a blur; and unless it is constantly watched, it cannot be relied on. The pencil does not give so permanent a record, but it can always be relied on; and if a good drafting HHH or HHHH lead be used, and sharpened whenever necessary, a clear distinct curve is plotted, which may afterward be traced over with ink. The recording cylinder is generally made of wood, of dimensions depending on the work to be done, and is geared to a clock movement so that its surface will pass through equal spaces in equal known intervals of time. In the more elaborate gauges, in which the curves are plotted on continuous rolls of paper of indefinite length, the paper is unrolled from one drum, passed partly around, pressed against and propelled by the recording cylinder, on which it receives the curve, and wound up on another drum to be removed at stated intervals. The recording cylinder sometimes carries fine pointed markers, which puncture the paper near the top and bottom at hourly and half-hourly intervals, which points are afterward used in ruling the time divisions. In the simpler and less expensive forms, the paper is wrapped around the cylinder, which is geared to revolve once in one or two days, a week, a month, or in any required time. The paper is properly secured to the cylinder and is changed with each revolution, or, if the curves are simple and not liable to become confused, the same sheet may be used several times in succession without change. By some this latter method—of re-using the paper—is preferred, because it gives the record in a more compact form.

The scale to which the curve is to be plotted is a matter of individual preference. Where the record is to be used for analytical study, as in the Coast Survey tidal observations, the curve is plotted to as large as can be accommodated on the recording mechanism. But for all practical purposes, as in ordinary tidal observations for determining the rise, fall, range, etc., and for observations in reservoirs and on streams and rivers, where the principal object is to keep an accurate record of the variations in the height of the water, a smaller scale may be used. With a range scale of one inch or one-half inch to the foot, the height of the water can be read off on the curve to the fraction of an inch. The smaller the time scale is made the more compact the record will be ; and this in the course of years becomes a matter of serious consideration. A very convenient scale for most purposes is one-tenth inch to the hour, which can be obtained with one revolution of the cylinder in a week. One-tenth inch equal to two hours gives one revolution in two weeks ; one-tenth inch equal to four hours, gives one revolution in one month. These scales, when used in conjunction of a range scale of one inch or one-half inch to the foot, possess the advantage that an accurately divided cross-section paper can be used at a great saving of expense and trouble, which would otherwise be involved in ruling and preparing the sheets.

AMERICAN WATER-WORKS ASSOCIATION.

The annual meeting of the American Water-Works Association was held in Buffalo (N. Y.) on Tuesday and Wednesday last, May 15 and 16. There was quite a large attendance of members from all parts of the country, and a number of additions to its membership were received.

Vice-President Briggs presided and Secretary Decker was present. The latter submitted his report, which shows that the association has a membership of eighty-four. The receipts during the year were $326, and warrants were drawn on the treasurer for $283.55.

The treasurer, Horatio D. Wood, of St. Louis, reported that the total amount of the funds which had come into his possession are $535.60, and the disbursements aggregated $290.55, leaving a balance of $245.05.

After the transaction of the routine business, W. C. Stripe of Keokuk (Iowa), read a paper on the "Relative Economy of Constant and Intermitted Pumping." He directed attention to the salient points of the two systems and then left the subject to the reflection of his associates, believing that the facts set before them would enable each for himself to decide upon their respective merits and economy.

Following the discussion of the paper of Mr. Stripe, another was read by Mr. Croes, of New York, upon "The Methods of Filtration of Water in use in the United States with Details of Construction, Cost and Efficiency." The methods of artificial filtration used in this country since 1831 were described with much fullness, and the most recent successful appliances for mechanical filtration used here and abroad were noted. This paper excited much interest among the members and its early publication was asked for by a great many.

J. G. Briggs, of Indiana, read a paper on "The relative economy to towns of a supply of water under municipal control and under control of private corporations," taking the ground that it was more advantageous to towns to be supplied by companies than to run their own water-works. Some of the members were inclined to question the writer's views on the preponderance of politics in water-works offices, but the general statements were acknowledged to be forcible.

At the evening session a paper was read by Peter Milne, Jr., of Brooklyn, his subject being "Plumbing work ; its effect on the health of the family." This paper was listened to with much interest.

On Wednesday, President Foster presented some tubulated statistics relating to the pumping machinery and expenses in 47 cities. The tables were looked on as exceedingly valuable. Mr. Croes presented to the members present copies of the pamphlet of Statistics of all the American water-works from which returns has been received.

The Association passed a vote of thanks to President Forster for the tables he had prepared, and also to Mr. Croes and to the publishers of ENGINEERING NEWS for their labors in preparing the comprehensive summary of valuable information.

George A. Ellis presented a paper on the method of determining the flow of water in pipes, illustrated by diagrams and printed tables, which was received with many expressions of approval. The officers elected for the ensuing year are : President, J. G. Briggs ; Vice-Presidents, W. C. Stripe, J. J. R. Croes, L. H. Gardiner, C. Schon, G. A. Ellis ; Secretary and Treasurer, J. H. Decker. Other interesting papers were read, the details of which have not reached us as yet. The closing proceedings will be noticed in our next issue.

THE CITY ENGINEER OF FT. WORTH, TEX.

DALLAS, Texas, May 13th, 1883.

EDITOR ENGINEERING NEWS :

In the "News of the Week" in your issue of May 5, you mention that the Ft. Worth (Tex.) water-works were officially tested April 25, and inadvertently add, that W. M. Johnson is City Engineer, and A. M. Wheel is Superintendent of waterworks.

Now we were present as distinguished guests, being both from the City of Dallas (Tex.), officers in above named capacity, as you may see from above letter heading.

But the City Engineer of Ft. Worth (Tex.) is Mr. E. R. Smoot, a very clever gentleman and an able engineer, enthusiastic, energetic and competent. Yours truly, W. M. JOHNSON.

PERSONAL.

WILLIAM WAINWRIGHT, of the Grand Trunk, is appointed general manager of the North Shore railway.

E. D. DAVIS, son of city Engineer E. A. Davis, of Northampton (Mass)., has been appointed first assistant engineer of the Boston, Hoosac Tunnel & Western railroad, with headquarters at Saratoga, N. Y.

C. R. WISE, lately Resident Engineer of the New York, West Shore & Buffalo Ry., has been appointed Chief Engineer of the Brunswick & Western R. R., with headquarters at Albany, Georgia, Mr. WISE succeeds Col. C. L. SCHLATTER,

who has been the Chief Engineer of the road since 1856.

THE GRAYDON & DENTON MFG CO., have opened an office for the sale of their Rock Drills and other specialties at No. 1 Park Place, New York. The location is convenient to access, being one door from Broadway, close to the Park Place station of the Elevated R. R., and near the Post Office and City Hall. They cordially invite interested parties to call and examine their "Dynamic" Rock Drill.

JOHN MACLEOD, Mem. A. Soc. C. E., the recently elected Vice-President and General Manager of the Union Railway Company and Belt R. R., with headquarters at Indianapolis (Ind.), will assume the duties of his new position on June 1. Mr. MacLeod commenced railroad life on the Louisville & Nashville Road under his father, who for many years was chief engineer of the L. & N. system. In 1870 he was appointed chief engineer of the Elizabethtown & Paducah Road, which position he held until 1872, when he accepted the position of superintendent of the Louisville, Cincinnati & Lexington Road, or the Short Line, a road which was in bad shape financially, and shortly after dropped into the hands of the courts, and Mr. MacLeod was appointed receiver, which position he held until 1879, when he accepted the position of general superintendent of the Louisville, New Albany & Chicago Road, which, under his able management, has come to be one of the most important north and south roads.

CHIEF ENGINEER WILLIAM K. PARK has been re-elected at the Philadelphia Gas Trust election.

OPENING OF THE EAST RIVER BRIDGE.

The great event of the coming week is the official opening of the great bridge which joins the the cities of New York and Brooklyn. The following is a condensed programme of the exercises:

President Arthur will attend the opening ceremonies of the East River Bridge on May 24, and after they are over will dine with Mayor Low. The President and such members of his Cabinet as accompany him, Gov. Cleveland and other distinguished guests will be escorted from the Fifth Avenue Hotel by the Seventh Regiment to the bridge and across it as far as the Brooklyn anchorage, where they will be received by the Twenty-third Regiment, which will act as the escort to the station building at the Brooklyn terminus, where the exercises will be held at 2 p. m. J. S. T. Stranahan will preside, and after music by the Twenty-third Regiment band and prayer by Bishop Littlejohn, William C. Kingsley will make the presentation address on behalf of the trustees. Mayor Low will then respond in an address of acceptance in behalf of Brooklyn, and Mayor Edson will respond in behalf of New York.

An oration will follow by A. S. Hewitt, representing New York, and the Rev. Dr. R. S. Storrs will speak in behalf of Brooklyn. The exercises will close with music by the Seventh Regiment band. The second story of the station building will be used for the services. It will accommodate all the invited guests. The space will be divided into sections, one being occupied by the President and Cabinet, the Governor and staff, the United States Senators, Members of Congress, and Governors of other States; one by the members of the Legislature, the Common Councils of New York and Brooklyn, and the city and county officials of New York and Brooklyn; one by representatives of the army and navy and of the national guard, one by the press, one by specially invited guests, and one will be exclusively reserved for employés. The Marshal of the day, Gen. James Jourdan, will have complete charge; and to facilitate the arrangements for the display of fireworks in the evening, the bridge is to be entirely cleared at 6½ p. m. The invitation tickets contain a beautiful steel engraving of the bridge.

Mayor Low is to issue a proclamation to the citizens of Brooklyn, requesting them to illuminate and decorate their residences and places of business. He will decorate and illuminate his own house on the Heights in an attractive and costly way, and will give the President a seat at a window in an upper story where he can see the fireworks.

The present plan is to give the President an hour for dinner, an hour to see the fireworks, and then to take him to the Academy of Music, where he will hold a reception for an hour, beginning at 9½ p. m. Gov. Cleveland will dine at the Mayor's house, and will also join in the reception. The Academy is to be lavishly decorated, and a miniature of the bridge will probably be suspended from the arches. Two bands of music will be in attendance. It is probable that a salute will be fired from the crest of Fort Green Hill, upon a signal from the bridge tower, when the structure is declared to be formally opened; and as the President passes over the bridge, the navy yard guns and the forts will probably join in a thundering chorus.

There will possibly be a concert by a brass band at Fort Greene for those who cannot witness the ceremonies of the opening. The plan of a street parade has been abandoned. The suggestion fell flat upon the Brooklyn community, and when the Aldermanic committee invited those who would take part to attend a meeting, no one responded. The public buildings, in accordance with Mayor Low's taste, will fly the national, State and city flags, streamers, in his opinion, appearing too tawdry. The public buildings are to be illuminated with gas. The city will expend about $5,000 in the celebration.

Five of the new cars for the bridge railroad arrived on a scow at the dock at the foot of the Brooklyn tower on the 15th. They are light brown on the outside, and are lined in olive green. They bear the words "New York and Brooklyn Bridge," in gilt letters on the side. Four of the cars are 39 feet 3½ inches long, and one is 27 feet 8 inches long. There are twenty of the long cars in all, built at a cost of $3,465 each, and four of the small cars, built at a cost of $2,865 each. They are modeled after the cars of the elevated railroads in this city, but are six inches wider. They are finished in mahogany and maple; and have cane cushioned seats. In the large cars forty-six passengers may find seats. There are double sliding doors of mahogany at each end, and there are spring gates, which are under the control of the brakemen. The cars will be lighted with six lamps. They are also provided with a common wheel brake and also a vacuum brake, the reservoirs being charged by the shunting engines that will shift the cars at the termini of the bridge. There is a gauge on each car which indicates the amount of pressure. The brakes include the improvement made by Eames, which led to a quarrel resulting in his homicide by H. W. Hughes, his superintendent. The cars were built in Wilmington. Five more cars are expected soon.

THE RAMAPO SCHEME.

Some of the questions of hydraulic engineering involved in the project for bringing the Ramapo water to New York, are discussed by ENGINEERING NEWS in its last issue, at considerable length and in a manner displaying a thorough acquaintance with the principles at issue and the peculiarities of the scheme which has been advocated. The discussion is timely, and is of interest as illustrating very forcibly the ground we have taken, that the Ramapo scheme was not sustained by impartial evidence, but was put forward on insufficient and one-sided arguments.

The point particularly dwelt upon by ENGINEERING NEWS, is the insufficiency of the proposed reservoirs to furnish permanently the quantity of water which the bill now in the Governor's hands requires to be guaranteed.

It is shown that the assumptions of the Ramapo engineers, regarding the probable rainfall, are not based on the observed facts, nor even on sound theory, and that even with the most liberal allowance, the storage capacity proposed to be furnished by the embryo company, while it may suffice for average years, will unquestionably fail in a year of minimum rainfall. To insure a daily supply of 50,000,000 gallons, from 85 square miles, will require very much greater storage capacity than can be furnished for the money proposed to be expended.

Regarding a supply of water for fires, the writer makes a suggestion which strikes us as eminently practical. It is, that instead of gathering "the water from a score or more of reservoirs in Rockland County, with all their automatic contrivances under private management, and bringing it in four lines of pipes under the Hudson River and selling it to the city," a line of pipe be laid to the Boyd's Corners reservoir, in the Croton Valley, which is 41 miles from the city, and 600 feet above it. This is a simpler, cheaper and more effective method of getting a fire pressure than the complicated Ramapo scheme, with its contingencies of lawsuits and possible entire failure.

We are glad to see this subject, of so great importance to this city, treated on its merits as a scientific and practical problem by our contemporary, and we venture the opinion that if any money is ever furnished to carry out this Ramapo project, it will be because some speculators believe that they can construct their plant from plans of their own, without interference from outsiders, and just durable enough to hold water till they can sell it to the city. To our mind, few schemes within late years suggest greater possibilities of fraud and rascality.—*Sanitary Engineer.*

BRITISH COLUMBIA.

PROSPEROUS CONDITION OF THE PROVINCE—PROGRESS OF PUBLIC WORKS.

VICTORIA (B. C.), May 1, 1883.

After remaining dormant for nearly ten years, the force of events is pushing the city of Victoria, B. C., forward, and although a "boom," in the American sense of the term, is not in full blast, something approaching it exists. The upward movement is slow, but it has the characteristics of stability and permanence. Property in the city and suburbs is in demand and advancing in value, new buildings are under erection or contracted for on the chief business streets, and real estate of a desirable kind is changing hands quite frequently. As if to fan the flame, one of the principal topics of street discussion is the large influx of strangers to the city and the promptness of their absorption into local industries.

The government dry dock at Esquimalt, which measures 400 ft. in length by 200 ft. in width, will, on completion, be a work of great utility. This desirable end cannot, however, be attained for eighteen months yet. There are 200 men at present employed on the dock.

Onderdonk's Canadian Pacific Railway contracts are now in full swing, giving employment to 4,000 Chinese and 2,000 white men, besides a number of Indians. Already $3,000,000 has been expended on the sections under construction, which are being pushed forward with much vigor and great executive ability, embracing, as they do, some of the heaviest blasting, tunneling and bridging yet achieved on any American railway. The syndicate pledged themselves to have the the road from the Atlantic to the Pacific completed within four years, when it is expected that European emigration on a stupendous scale will begin to colonize the fertile wheat lands of the great Northwest and the cattle ranges of British Columbia. In fact, the completion of this latest transcontinental highway will either "break" or "make" the Dominion for many a long year to come.

There are 17,000 Celestials in British Columbia—4,000 of them are at work on the Canadian Pacific Railroad, and the remainder are distributed among nearly all avocations, except law and divinity. They have appeared in every hamlet and town on Vancouver Island and the mainland like a locust swarm, which, in fact, would be far less pernicious to the country. The outcry against them is great, but this fair province is a veritable paradise for the heathen, as here he lives cheaper than in many other parts of the Pacific coast, besides getting better wages. A single Chinese firm in Victoria has at present in keeping $250,000 of savings, mostly from the ranks of the railroad host, and other firms have lesser sums. Every dollar goes to China without increase or curtailment by entering into trade transactions. The day of prohibition and exclusion for John is near at hand, however, judging from measures at present before the Provincial Legislature.

The thrift of the industrial classes of British Columbia is evinced by the fact that the Dominion savings banks throughout the province have upward of $1,000,000 on deposit belonging to them, which is a very large sum when it is considered that the entire white population consists of less than 30,000.

For the year 1882 the placer gold diggings of British Columbia produced $954,085, giving employment to 1,738 men (principally Chinese) or a yearly average of $548 per man. Some exceptionally rich mining claims are at present in the hands of Chinese. As yet there is no quartz mining in British Columbia, notwithstanding the existence of good lodes in every district.

Victoria stands sadly in need of a first-class hotel. No better investment exists in the city. At present every hotel and boarding-house whatever its status, is full to overflowing, but there is no first-class accommodation to be had.

The advent of the railroads is destined to make this province the jewel of the Dominion. At present it stands in the position of Colorado before the building of the Denver & Rio Grande Railway, which has been so instrumental in developing the resources of the Centennial State. With a similar railroad system to aid its development, the resources of British Columbia will astonish the world. Not only has the province great sea and river fisheries, magnificent waterways, penetrating into the very heart of the country, but unexcelled forests, fields and mines, which only await the magic touch of the railway engineer to make them yield untold millions of wealth. Apart from the public works now under construction, there are numerous openings for mechanics throughout the province, and many business opportunities are to be found in the smaller towns of the interior, which are already beginning to attract population and trade. This is especially the case on the line of the Canadian Pacific Railway from Port Moody, the terminus, to Kamploops and beyond. The latter place, situated at the forks of the North and South Thomson River,

commands the trade of the richest grazing and agricultural section of the province.—*Correspondence of the San Francisco Chronicle.*

IN AND OUT OF WALL STREET.

The old fogies of Wall street have a saying that "as days grow longer prices get stronger." The saying is based upon the belief that with the advance of the spring and the reports of crop prospects and increased immigration, speculation in railroad stocks tends to revive. This has often proved correct, and after the April and May settlements were over, a bull movement has frequently begun. This year, however, there seems to be little chance of history repeating itself. The crop prospects are by no means encouraging. It is generally conceded that the "winter killing" will reduce the wheat crop by 20 per cent. Few people studying this question expect the country to produce more than 400,000,000 bushels of wheat against the 500,000,000 of last year. Of corn there is not enough left for home consumption till the next harvest, and the season being very backward and most of the seed likely to be very poor, famine prices are anticipated for this staple by many a Chicago and Wall street wiseacre. On the other hand, money, instead of being liberated as it usually is at this time of the year, is being withdrawn from the speculative market by men like Messrs. Vanderbilt and Gould, who are "retiring into private life," and by others who contemplate going away for several months. They all pick up such bonds as appear cheap to them, and leave the stock market to take its own course. W. H. Vanderbilt has disappeared officially. His son, W. K., talks of quitting railroad business and Wall street as soon as he can. Jay Gould says that he has been getting out of everything for the last two years, and does not propose to get in again. "Charley" Osborn goes to Mamaroneck, and intends to rusticate there till the fall. Cammack has gone to Europe, and has taken the position of a retired Southern gentleman who has made all the investments he wants and does not propose to speculate any more. J. R. Keene is going to Europe, and sells everything he can get a good price for. "Bob" Hutchings does not want to hear of anything except the enjoyments of family life and the newest French novels. H. N. Smith talks of going to Europe as soon as possible—which means as soon as he has disposed of his heavy loads of stocks. The Rockefeller or Standard Oil crowd have been selling out their holdings as fast as they could. Thus of all the active manipulators of Wall street there are only three left—Russell Sage, W. E. Connor and D. O. Mills. But Russell Sage never ventures upon anything on his own hook. He is not a head cook; he is merely an assistant in the scullery. His specialties are puts and calls, and it is mainly by them that he helps a big banquet to a satisfactory consummation. He will probably make more money this summer than ever out of the sale of his privileges, for the mass of petty speculators will be afraid to go into the market unprotected. But he will never start any big movement himself. D. O. Mills is what is called in poker slang "a stayer from Stayersville." He has a big lot of bonds, like the Buffalo & West Shore and the Erie; he has taken them out of the street and will sit on them till he sees his way out with a profit. W. E. Connor is thus the only remaining star of this brilliant constellation. But he is a thorough radical in business. He has no sympathies or prejudices, and does not care a straw whether the market goes ten points up or ten points down, as long as it goes that much one way or the other. He can therefore not be expected to put the market up or down of his own accord. All he is likely to do is to watch it as a cat does a mouse, and jump on it or at it the moment he sees his opportunity.

All this means that Wall street is left severely to itself and that affairs there have to stand on their own merits. The public have long been clamoring for something of this kind. Unscrupulous manipulation has disgusted and drawn away all the outsiders. The general opinion has been that the public were tired of playing against loaded dice and that nobody would have anything to do with the stock market until the business there was placed upon some sort of square and equitable basis. Now the great manipulators are all out, the roads are mortgaged and stocked to their utmost extent, the old marginal tricks have all been exposed over and over again, and any man of average intelligence ought to be able to find out what this or that particular property is worth. All that is wanted is not to spread one's self over the whole market, but to study one or two specialties and restrict one's investments or speculations exclusively to them. The market may go within the next two or three months twenty points lower, as it may go twenty points higher. A great deal will depend upon the weather, the developments in regard to the crops, at home as well as abroad, and the condition of political affairs in Europe. If capital from the Old World is forced to seek refuge here, if we have plenty of breadstuffs and provisions to spare, and if Europe runs short, we may have a big boom before we know it. But as long as things remain in the present undecided condition nothing can revive Wall street business.—*New York Sun.*

NEWS OF THE WEEK.

DETROIT SEWERS.—The Board of Public Works has been petitioned to construct six sewers.

DETROIT PAVING.—Grand River avenue wil probably be paved this year. The property owners want a pavement of stone and wood, 12 ft. of cedar blocks on either side of the street railway track. A board foundation was given up as being an infringement on the Philips' patent.

PORT HURON (MICH.) WATER-WORKS.—The water-works are in a very prosperous condition. Over a mile of new pipe was laid in 1882, making a total of 19 miles of mains.

WATER-WORKS FOR ANN ARBOR (MICH.)—The Common Council have appinted a committee to consider the question of water-works.

NEW RAILROADS.—The Oregon-California has the California extension open to Glendale, 65 miles South of Roseburg (Oreg.) The Missoula Division of the Northern Pacific has now laid the 376th mile of its track. A meeting of the merchants of Fergus Falls (Minn.) was lately in consultation with the Hon. C. F. Washburn with regard to building a road from Fergus Falls to Brown Valley. A company has been formed and a line will probably be built southwesterly, crossing the Breckinridge Division of the Manitoba line at Tintah and thence across Traverse County to Mandada and Brown's Valley.

ST. PAUL (MINN.) WATER BOARD.—Several new mains were authorized at last meeting, and plans were submitted by Engineer Waters.

BROKEN LEVEE.—The levee at Paterson (La.) gave way, forming a crevasse fifty feet wide and ten deep.

PHILADELPHIA NEW GAS CO.—Leading business men in Philadelphia are endeavoring to start an opposition gas company.

MINNEAPOLIS BOARD OF WORKS.—A bid by John Dougherty for the construction of a sewer on Fort street for $19,374 was rejected. The engineer was directed to make new specifications for sewers on Fort aud St. Clair streets.

A NEW GAS CO. is to be organized in St. Cloud (Minn.) with a capital of $20,000.

CONTRACT AWARDED.—The contract for grading and masonry on the Bangor & Piscataquis extension from Blanchard to Moosehead Lake has been awarded to Flynn & Shanahan of Portland (Me.).

RAILROAD EMPLOYES wanting positions on the New York, West Shore & Buffalo, should apply to Mr. J. E. Childs Asst. Superintendent, 15 Broad St., New York.

AN EXTENSION OF B. & O. R. R.—During the summer the Baltimore & Ohio will build a road from Erie to Somerset Co., in order to reach the lakes by a short line. The road after leaving Erie will pass through Waterford, Millvillage and Titusville, and will run southeast through Forest, Jefferson, Clearfield, Cambria and Somerset counties.

PHILADELPHIA CONTRACTS.—At the last meeting of the highway Committee of Councils one of the members urged that it be subdivided into district committees. Others objected that ward committees would be subject to the influence of contractors and speculators. A motion was made to allow Mr. W. Conklin to withdraw his bid, but it was voted down.

NORTHAMPTON (MASS.) WATER-WORKS.—Engineer E. C. Davis has been making plans for the proposed reservoir in Roberts' meadow brook. Two reservoirs are talked of—one near the Roberts Meadows to contain 15,000,000 gallons, the other at Bridgman's Farms to contain 99,000,000 gallons. The present reservoir has a capacity of only 4,000,000 gallons.

NEW RAILROADS.—A movement is on foot to build the Peoria & Farmington road into Peoria. The Northern Indiana Air Line has been incorporated. The route will run from Richland, Steuben Co., to Stillwell, Laporte Co. The capital stock is $1,000,000.

SURVEYING THE INDIANAPOLIS, EEL RIVER & VINCENNES.—A surveying corps is now locating this line, and it will probably be built within eighteen months.

RAISING A LEVEE.—The people of Mound City (Ills.) have hired an engineer to make surveys and estimates of building their levees one foot higher than the highest flood line. The work is to be begun immediately.

THE INDIANA PACIFIC.—BOURBON, Ind., May 15.—The surveyors on the Indiana Pacific railroad have passed this place locating the proposed route. It begins at North Judson and terminates at Auburn, Ind. Work will begin on the proposed road in a short time, and will be speedily pushed to completion. It is believed that the Baltimore & Ohio road is interested in the proposed route and will lend material aid at the proper time.

BRIDGES FOR LONG BRANCH (N. J.)—The Board of Freeholders have decided to build a bridge over the Glimmerglass, and also a bridge over the South Shrewsbury River, at Pleasure Bay.

HUDSON RIVER NAVIGATION.—Certain bills before the Governor affecting the navigation of the Hudson were discussed at a special meeting of the New York Chamber of Commerce yesterday.

NEW ELECTRIC COMPANY.—The Commercial Underground Electric Company has been incorporated at New York. It is to construct, use or lease telegraph wires.

NEW MEXICAN RAILROADS.—The Federal government has granted a concession to the State of Michoacan for the construction of three railroad lines to connect with the Central.

WINNIPEG'S (MANITOBA) CITY ENGINEER.—The City Council have applied to the courts for a mandamus compelling the Mayor to sign a by-law appointing Edward Wassell, city Engineer, instead of General Rosser. The affidavits allege that the Mayor is pecuniarly interested in Rosser's appointment.

THE DULUTH & IRON RANGE CONTRACTS.—Nine bids for the construction of the road were received at Duluth. The engineers have to examine them.

NEW WATER-WORKS.—Cohoes, N. Y., Revere, Mass., Newton, N. J., Lynn, Mass., Philadelphia, Pa., Lewisburg, Pa. and Quebec, Can., are moving for more water or additions to machinery.

THE NORTHERN PACIFIC CONTRACT FOR WISCONSIN.—Hugh Richards and L. A. Dabney, of Jackson, Mich., have secured the contract for constructing the West Wisconsin Division, extending 60 miles, from Superior City to Ashland. They are to grade, tie and iron the line ready for trains. The price is nearly $10,000 per mile.

HE NUMBERED THEM.—"The plan of numbering the Italian laborers on the West Shore road," says the *Kingston Freeman*, "works like a charm. Finding it impossible to keep track of the men by their jaw-breaking names, the contractors concluded to number them. The number of each Italian is painted in plain figures on the seat of his pantaloons. Before beginning work in the morning and at noon and again at night the men are formed in line, and the foreman passes in the rear of them and takes down each namber, in order to ascertain who is present as well as who is absent. The plan is beneficial in two ways—the men are easily recognized, and they are also kept from sitting down too much for fear of rubbing out the figures on the seats of their pantaloons."

NEW NEBRASKA ROADS.—Articles of incorporation have been filed with the Secretary of State for the Plattsmouth and Southwestern, the Fort Scott, Topeka and Lincoln, and the Lincoln and Topeka railroads. The Plattsmouth and Southwestern is to run through Avoca, Syracuse, Sterling, Beatrice, and Fairbury, to the State line; capital stock $900,000; incorporated by Plattsmouth men. The Fort Scott, Topeka and Lincoln line is to pass through Pawnee, Gage, Johnson, Otoe, and Lancaster counties in Nebraska; capital, $1,500,000; incorporated by Fort Scott men. The Lincoln and Topeka Railroad is incorporated by men of Pawnee City, Neb.; stock, $500,000.

THE DULUTH & IRON RANGE ROAD CONTRACT will be let on Monday next at St. Paul, (Minn.) Seven or eight bids have been already received. President Tower will arrive saturday, and will be accompanied by G. H. White of Escanaba, who will have charge of the erection of ore docks, and A. H. Viele, the recently appointed auditor of the road. R. H. Lee, chief engineer, arrived in St. Paul a day or two ago, from Philadelphia, and left with his full corps of engineers for Duluth.

A BIG DREDGE BOAT.—The Okechobee company launched at Kissimee (Fla.) the dredge boat President Arthur, the largest in America. It will excavate 20,000 cubic yards per day. It is designed to cut a canal sixty-five feet wide and ten feet deep. The company will commence operations at the lower end of Lake Kissimee and go direct to Okechobee. The completion of the canal will reclaim 4,000,000 acres of sugar land.

THE Exchange Building at Houston (Texas,) is to cost $50,000.

PETITION OF SETTLERS FOR THE APPOINTMENT OF A SURVEYOR.—United States Surveyor-General Brown is in receipt of a petition, signed by A. J. Bryant, P. H. McGrew, Chairman of the Settlers' League; W. H. Buckley, L. A. Rutherford, S. C. Dean, William E. Yates, James Stewart, John Connors, Frederick Reeder, J. M. Frazer and others, claiming to be settlers on El Sobrante and asking for the appointment of William Minto by the Surveyor-General to make a survey of 70,000 acres of disputed land located in five townships. Surveyor-General Brown is doubtful as to the fitness of Minto, because he is alleged to be personally interested in the lands in route and is suspected to be

in collusion with a clique of monopolists. At present there are not sufficient available funds to order the survey, about the legality of which there is still a conflict of authority between the United States District Court and the Secretary of the Interior at Washington. Surveyor-General Brown says that the interests involved are so extensive that it is probable that a special purse may be raised to defray the expenses, in which event he should not hesitate to order the survey. Relative to the appointment of a surveyor, he desires to make such a selection as will be acceptable to the settlers, provided that they can prove to him the legitimacy of their petition. If not, he will then choose himself some impartial surveyor.—*San Francisco Chronicle, 9th.*

VALUABLE ROAD METAL.—A few days ago a Mexican was seen picking up stones on one of the streets of Virginia City (Nev.) The street had recently been macadamized with stone taken out of the old waste dumps, where the refuse ore from one of the mines had been thrown twenty years ago, The Mexican collected sixty pounds of valuable ore from the street.

A STREET WORK DECISION.—The decision of ex-Judge Latimer, rendering judgment for the plaiutiff in the case of P. Gality vs. William Leviston and others, was reversed by the Supreme Court yesterday. The action was upon a street assestment for grading the crossing of Broadway and Gough street. The record showed that the property owners upon whose petition the Supervisors were authorized to order that kind of work did not petition to have it performed, nor did the Superintendent of Streets recommend that it should be done. The appellants contended that without such a recommendation the Board couid not acquire jurisdiction to order the work to be executed. The Supreme Court holds that such is its understanding of the law under the statutes of 1871-72.—*San Francisco Chronicle 9th.*

AN IMPORTANT PATENT DECISION.—The Secretary of the Interior has confirmed the decision of the Commissioner of Patents, holding that he has authority to institute proceedings like those in interference cases, to obtain testimony upon which to determine whether an invention has been in public use or on sale for two years or more prior to the filing of an application for a patent therefor. Under this decision a new practice will be established in the Patent Office, substantially as follows: Where a petition is presented asking that an investigation be made to determine whether an invention which is the subject of an application for a patent has been in public use two years, the Commissioner will direct the Examiner of Interferences to fix a time for taking testimony by the petitioner to show the facts alleged in the petition, giving thirty days for the production of such testimony. At the expiration of that time the inventor or his assignee may produce testimony to show that the facts alleged are not true. The testimony will be returned to the Patent Office and considered.

ST. GOTHARD TUNNEL.—Investigations have been made of the cause of weakness in the parts of the St. Gothard tunnel where the vaults were crushed, and it is thought that the accident must be attributed to the action of the damp air upon the shists and gneiss, and to the decomposition which resulted therefrom. The presence of anhydrous sulphate of lime, or karstenite, was also an important agency, its transformation into gypsum being followed by a disaggregation which renders the rock incapable of sustaining its pressure. Other hypotheses have naturally been framed, but this is considered as the most plausible.

CLEARING FOR THE CANAL.—Crossing the Isthmus by rail I noticed the whole line of the canal laid out and cleared. The clearing was evidently done some time ago, for in many places the underbrush has grown up again. Stations for working purposes have been established at many points, and a narrow-gauge road is being constructed along the whole line of the proposed canal to carry material and take away debris. Evidently the company have plenty of money, for everything is being prepared regardless of expense. While all the work is being carried on in a systematic and scientific manner, the whole undertaking lacks the push and energetie spirit so peculiar to Americans. They have four men to do one man's work, and while they have an army of high-salaried officials, the bone and sinew of the work-the mechanics-are poorly paid and the laborers do pretty much as they please. All told there are a little less than 1,800 persons employed on the canal at present. They speak of putting on 40,000 laborers, but I could see no indications of any such increase. At every step you stumble against some *Chef Commandant, Ingenieur, Chef des Ponts et Chaussees*, or some other chap with high-sounding title and drawing a big salary, alternating with some poor devil of a laborer, yellow with fever and debility, The former get furloughs and go to France to recuperate: the latter generally die. Young M. De Lesseps is at present on a visit to the Isthmus, and evidently doing his best to reform some abuses, but will not things go back into the same groove after his departure next month? They started to put up a fine hospital, all complete, with a graveyard attached. The *chef* had a gate made, first, nine feet wide. After it was put up it did not suit him, so he had a new one constructed, fifteen feet wide, and now a third one is being finished, twenty feet wide. The cost of this hospital is already $300,000. On the Panama end nothing is being done yet. The offices of the company are located in the former Grand Hotel, and already the town of Panama has been greatly benefited. Since the completion of the overland railway it had lost a great deal, but is again coming to the front, and business is now on a firmer footing than ever before.—*San Francisco Chronicle.*

THE CHURCH STREET RAILWAY COMPANY, Jacksonville (Ill.) has been incorporated: object, building and operating a street railway on Church street and Lafayette avenue, Jacksonville; capital, $5,000; incorporators, H. L. Hatch, William E. Nilch, P. G. Gillett, John A. Ayres, Alex. Smith, T. Rice Smith.

CHICAGO ELEVATED RY.—The commissioners appointed to open books of subscription to the capital stock of the Chicago Elevated Railway Company, incorporated April 3, have made a final report to the Secretary of State that the stock had been subscribed for as follows: E. H. Spooner, $2,000,000; William S. Fell, $2,000,000; and R. M. Bacon, $1,000,000; total, $5,000,000. The incorporators met in Chicago, and elected the following to serve as directors for one year: William S. Fell, E. H. Spooner, R. M. Bacon, A. W. Foster and James Alden. They announce that they are prepared to proceed to business at once.

THROUGH A BRIDGE.—PENNSBORO, West Va., May 13.—A passenger train on the Pennsboro & Harrisville Railroad was precipitated into the Hughes River yesterday by the giving way of a bridge. None of the passengers were injured, but Frank Foster, the conductor, and W. H. King, the engineer, are supposed to have been killed. The train fell 15 feet.

RAILWAY IN ASIA MINOR.—It is reported that some French capitalists have obtained permission from the Turkish Government to construct a railway across Asia Minor from the Sea of Marmora to the Persian Gulf. It is to be known as the Euphrates Valley Road. This scheme has been frequently broached by English and other engineers, but without practical results.

F. B. GOWEN.—President Gowen's days of ill luck seem to have turned. A paper is in circulation among the stockholders recommending an increase of Mr. Gowen's salary to $50,000 per year. Mr. Gowen, by virtue of the presidency of the Reading, will also become manager of the Jersey Central by virtue of the lease of the latter to the former.

THE BELLE ISLE CANAL (MICH.) Collins & Jeynes will begin work on the Belle Isle canal at once. They calculate that about 1,000 yards of excavation will be accomplished each working day until the completion of the contract. The same firm is now engaged in constructing section F of the grand trunk sewer at Buffalo, for which they will receive $76,000.

THE COUNCIL OF THE TOWN OF LAKE (ILL.) passed a resolution authorizing the employment of experts to examine all the books of the town, and to report on the engineering system and its practical workings, the investigation to extend as far back as the supervisor may elect.

THE BASIC PROCESS.—The Pennsylvania Steel Company of Harrisburg, under the management of Major Bent, has recently begun regular work in making steel and phosphoric pig under the Thomas and Gilchrist patents.

FLORIDA RAILROADS.—The railroad construction business in Florida is booming.

THE KNOX & LINCOLN (MASS). R. R.—A large amount of work has been laid out along the route of the Knox & Lincoln Railroad for this season. About 500 tons of steel rails will be laid, a change made in the location of the road at Thomaston, so as to do away with an expensive trestle work, and an extension of the road probably made at Rockland so that passengers and baggage may be delivered at the wharf of the Mt. Desert and Bangor steamers.

IMPROVING THE MISSISSIPPI.—The Commercial bodies of New Orleans met last week to hear the remarks of George L. Wright, of the St. Louis Merchants' Exchange, on the importance of united action by the commercial bodies of the Mississippi valley for the improvement of the Mississippi River. Committees of nine leading commercial bodies of the city resolved to consolidate the different committees into one organization under the name of the Mississippi River Improvement Committee.

A NEW NICKEL-PLATE is the Colorado Northern. The company which has this line under construction is the Seney syndicate, the same that built the Nickel-plate road from Buffalo to Chicago, paralleling the Lake Shoro. The head and front of that movement was S. C. Brice, who is the Vice-President of the Colorado Northern. General L. M. Meily is President; and Samuel Thomas, President of the East Tennessee, Virginia & Georgia railway, is also one of the projectors. Vice-President Brice says the outcome will be a transcontinental narrow-gauge line from Denver to San Francisco. The California & Nevada railway is a part of this system, and construction has already been commenced on it at the west end, at San Francisco. One hundred miles of the road is now under construction, and fifty miles of the road has already been graded. The western terminus of the line is at Richmond's Point, in San Francisco, which is one of the finest loading places for ships on the bay, as there is thirty feet of water in which to float them. From this point the line runs directly east through the garden spot of California, touching the great wheat and vegetable-producing regions, to within twenty-five miles of the Yosemite and within fourteen miles of Hatch Hatchety.

CHICAGO CONTRACTS TO PAVE twenty-five streets were awarded last week to J. B. Smith & Co., for cedar blocks, and John E. McMahon for most of those for Medina stone.

THE STILLWATER (MINN.) WATER COMPANY is in a prosperous condition, and is making improvements.

THE DULUTH WATER AND GAS-WORKS.—Work has been began by Fagan & Zimmerman, who have the contract for grading and excavating for these works.

THE ST. PAUL, (MINN.) CITY ENGINEER was ordered to make plans and estimates for the following: Grading of Leech street from Ramsey street to Goodrich avenue, and Terrace lane from Floral to Lawton street; paving of Fifth Street from Jackson to Sibley street; grading of Sixth street from College avenue to Oak street; grading of alley in block 18, Kittson's addition: grading of Delos street from Bellows street to Hall avenue; paving tunnel on Fourth street under railroad viaduct; grading Martin street from Rice to Dale street.

A NEW CONTRACT CO.—Articles of incorporation of the St. Paul Construction company have been filed with the Secretary of state. The general nature of the business to be transacted is to deal in mortgages, etc., and to contract for the construction of railroads and others improvements. The capital stock is $500,000.

DETROIT PAVING CONTRACTS.—The contract for paving High street was awarded to Dunn & Reaume for $3,465.

BIG LOAN TO DREDGING COMPANY.—The Manhattan Dredging and Elevator Company has given a mortgage to the American Loan & Trust Co. for $150,000, so as to enable the company to purchase the necessary scows and other machinery.

BRIDGE CONTRACTS.—Chief Engineer Morris, of the Cincinnati, Indianapolis, St. Louis & Chicago road, has let a contract to the Keystone Bridge Company to build a new bridge of two spans, 156 feet each in length, over Whitewater River on the Eastern Division, the bridge to cost $21,000. The right to build and maintain the Laredo bridge has been given to C. McDonald. The city is to receive $3,000 a year for the first five years and $5,000 a year for the ensuing five.

THE May cold spell is all right. It is accounted for scientifically by the simultaneous and generally accelerated dissolution of the congelation in the hyperboreal regions, caused by the contiguity of the solstitial period. We are glad to know all about it, and shan't mind it at all in the future, now that the reason for it is pointed out.

CLEANING THE APPOMATTOX CANAL.—The upper canal is to be cleaned out, and it is thought a line of boats will be put on it.

BRIDGES IN TEXAS.—A bridge is to be built across the Big Brazos River, at Bryan, Texas. Colonel Pierce has subscribed $2,000 to the La Grange Bridge Co. The bridge on the San Francisco road across the Arkansas River, at Tolosa, is almost finished. It is 1,400 ft. long, and took only 20 days in construction.

LAREDO (TEX.) GAS WORKS.—Mr. Foster, of Austin, has contracted to supply Laredo with gas.

NEW TEXAS ROAD.—Several capitalists at Fort Worth, Texas, are trying to have a line from Decatur to the coal mines.

THE WAYNESBOROUGH (PA.) GAS WORKS will be in operation in two weeks.

MR. VILLARD'S VIEWS.—At St. Paul Mr. Villard stated he had made arrangements to extend the Sauk line to Minneapolis. Our Yellowstone Park line from Livingston to the boundary of the park, we expect to have completed by the middle of August. The engineer in charge of the work told me that about twenty miles of the grade is completed, and the rest well in hand. During my trip, the syndicate represented by Drexel, Morgan & Co., August Belmont & Co., and others, who had the

option to take the entire issue of $40,000,000 of general first mortgage bonds from the company at a fixed price, and who have already disposed of $30,000,000, have sold the remaining $10,000,000 to a sub-syndicate. We shall extend the Jamestown branch to the vicinity of Devil's Lake, but have no intention of going beyond that.

AN OPINION ON CEMENT was lately received by the architect of the Texas State Capitol from Prof. W. C. Cummings, of Brooklyn, in reply to inquiries about cements for the concrete and stone work of the capitol. Mr. Cummings is positive that no cement of 350 pounds tensile strength can be found in Texas, and, if found, would be of the kind that sets too quickly, and that is likely to deterioriate, and, in a climate where temperatures are changeable as here, would in a few years disintegrate. He recommends several brands of American cements, slow setting and of the class that harden with time. The Portland cement, he says, is greatly overrated, and he looks upon it as a kind of well-advertised patent-medicine preparation. Mr. Cummings created something of a sensation by his announcement that the monolyth, Cleopatra's needle, was a solid piece of cement.

THE CANADIAN PACIFIC.—A letter from Winnipeg states that the Canadian Pacific Company has put a very large force of men upon the Thunder Bay branch with the intention of having the line in good working order in about a month. To accomplish this will require an expenditure of about $1,000,000. The Canadian Pacific Company purchased from the contractors their plant and rolling stock, worth about $200,000. The contract for the construction of the Manitoba and Northwestern from Gladstone to Prince Albert, 300 miles, is about to be let.

THE WELLAND CANAL is to be completed by Oct. 1.

CURTIS REGULATOR.—A uniform boiler pressure is a necessity in the production of a perfect electric light. By the use of the Curtis Pressure Regulator, the Edison Light Co., of New York, are able to maintain a perfectly uniform pressure on their large steam engines. They are 5 in. Regulators.

IMPROVING CHEESEQUAKE CREEK.—A dispatch from Mattawan, N. J., says: "The government contractors who have the contract for the improvement of Cheesequake Creek are rapidly completing the work. The dykes for the new channel are about finished, and the dredging machines have cut through the sandy point of land into Raritan Bay."

THE AMERICAN WATER-WORKS ASSOCIATION held its third annual meeting at Buffalo on May 15. The association includes 54 active and 26 honorary members, representing nearly all the States in the Union. The members are persons connected with the construction and management of works and persons and firms engaged in furnishing material for the construction and maintenance of water-works. Among the subjects discussed were the relative economy to towns of a supply of water under municipal control and under the control of private corporations, plumbing work and its effect on health, and the importance of engine duty in water-works. The association visited the Holly Works at Lockport and had a banquet at Niagara Falls.

THE NEW YORK EQUITABLE GAS LIGHT CO. has elected its officers and purchased two blocks of land between Thirty-ninth and Forty-first streets, and extending from First avenue to the East River, upon which gas-works will be erected. A contract has been made with W. J. Davison to construct the works, and other contracts have been closed for the laying of mains. The Equitable Company expect to produce 2,000,000 cubic feet of gas per day, which, under the terms of their charter, they will supply to the people at $1.75 per 1,000 feet and to the city at $1.50 per 1,000 feet. It is expected that the works will be in partial operation by next fall.

THE ALABAMA GRAND GULF & MEXICAN RAILROAD is the title of a new road that will run from the northwestern limit of the State, and on through the mineral region to Montgomery and Sandren Bay.

THE ATLANTA NEW GAS CO.—The City Council interposed in behalf of the monopoly of the old company, and the new company has taken the matter into the courts.

THE EASTON & BANGOR.—The Board of Trade of Easton (Penn.) is trying to procure right of way for this line through Easton. The company will begin building about June 1, at Stockertown, and build north to Wind Gap and south to Easton. The road will follow the Burkhill Valley, and at the mouth of the stream will cross the Delaware by a bridge and connect with the Belvidere Delaware road, a branch of the Pennsylvania. It will be a question of only a short time before the road is continued north through Wind Gap to Scranton.

BROOKLYN BRIDGE BOOKKEEPING.—The experts appointed will present their reports in about a month. A discrepancy of $20,000 has been discovered, but it may be accounted for by clerical errors, etc. There is evidence, in the opinion of at least one of the experts, that some persons in authority over the bridge-work may have been interested in contracts. The examination will be extended down to the day of the opening of the bridge so that the record may be complete.

THE MINNEAPOLIS & MANITOBA EXTENSION, from Bartlett to Creel City, is being pushed rapidly. Grading is going on on the first ten miles. It will probably be opened by July 4.

THE CHIPPEWA FALLS AND EAU CLAIRE ROAD is being looked after by the chief engineer of the Omaha Co., and the contractors will have their headquarters at depot of that company.

HIGH WORK AND HIGH WAGES.—The carpenters working on the high trestle over Norsent's Gulch have struck for $8 per day. They had been receiving $6, but consider that sum inadequate in view of the danger they incur in their work.

NEW ROADS.—Major Converse has gone to inspect the Sunset Railroad in Mexico. It is likely he will take steps to build the road from San Antonia northwest to a connection with the Texas & Pacific in Shackelford County (Texas). A meeting was held at Comanche (Texas) to secure a branch of the Texas & St. Louis narrow gauge line. The directors are requested to have surveys made from Gatesville.

QUINCY (ILL.) WATER-WORKS.—Owing to a disagreement between the City Council and the Water-Works Company with regard to annual rates, the company dismantled the hydrants in the city.

PUBLIC BUILDINGS IN INDIANA.—Sites for insane asylums were recently examined by the Governor.

TAMARACK PAVEMENT.—A letter from Marshall (Mich.) states that the native tamarack is a good wood for paving purposes, better even than white cedar, and that it will be tried on the main streets.

CHEAP IMPORTED LABOR.—Several farmers of Chelsea and neighborhood (Vt.) recently imported foreign immigrants at the rate of $108 a year and board, but the majority soon left again.

CLOSING A CREVASSE.—The crevasse at Kenner (La.) has been closed. The break occurred in the levee on the 11th, and three ineffectual attempts had been made to close the crevasse owing to the undermining of the front piling. Capt. Grant, chief engineer of the Mississippi Valley Road, began driving scantlings, heavily bracing them, a line of sheet piling in front, and sand-bags in front of that, the result of which was that at 7 o'clock in the evening the crevasse was closed. Capt. Grant kept a force of 150 men engaged all night strengthening the work, personally superintending the same. Material assistance has been rendered by the force furnished by the Jackson Railway Company under Superintendent Clarke, consisting of 100 convicts, which made in all about 250 laborers. The crevasse had materially widened and deepened to 10 feet, and for a time it was thought it would have to be abandoned. The break was the natural result of the closure of the Bonnet Carre crevasse, only a few miles above, the water running through to the route of the old outlet into Lake Pontchartrain.

DYNAMITE ANTICIPATED.—A gentleman writes to a Western paper: I was in Detroit in the winter of 1837. There was a person, whose name I do not now recollect, who opened a saloon near the ferry dock within a door or two of Wood's grocery. A small box was sent to his address, and when he attempted to break it open it burst with terrible violence, I think breaking his arm and otherwise injuring him, destroying everything in in the room and throwing out the sash and glass. Nearly half a century has elapsed since this transpired, and it is not surprising that I cannot now give more particulars.

A BIG LAND SLIDE occurred lately on the Dakota division of the Chicago, Milwaukee & St. Paul. Six hundred feet of the track went into the Missouri and disappeared entirely, the huge bluff towering above the track sinking down, causing an impossible barrier. It will take a week to repair the break. The amount of land affected by the slide is three or four acres.

THE CANADA SOUTHERN BRIDGE will cost $590,000. Mr. Vanderbilt furnishes the first cost. On the completion of the bridge Canada Southern will require the ownership by issuing therefor about $1,000,000 5 per cent. bonds. The company pays the International Bridge Association $75,000 a year, and notice has been given that the rental will be advanced to $150,000.

THE VANDALIA EXTENSION.—It is thought that the Vandalia road will be pushed as far as Michigan City. Wm. R. McKeene, President; Capt. A. B. Fitch, Chief Engineer and others lately visited Michigan City. It was stated that the new line was only located as far as Lake Maxinkuckee.

THE CANAL COMPANY MUST PAY THE POLICE.—PANAMA, May 14.—The Minister of the Treasury has warned the canal company that they must pay the expense of keeping between 2,000 and 3,000 men on the isthmus to maintain order, The Minister estimates that the cost thus imposed on the company during the fourteen years the contract grants for the completion of the canal will amount to $7,000,000, and may even reach $10,000,000 or $12,000,000.

THE CADET ENGINEERS.—WASHINGTON, May 14.—The Court of Claims to-day rendered a unanimous decision in the test case of Leopold vs. the United States. This suit was brought nominally for difference of pay, but in fact to determine the standing of the cadet engineers who graduated at the Naval Academy in the years 1881 and 1882. The Navy Department held that they were undergraduates within the meaning of the act of August last, and were transferred by that act into naval cadets and their pay cut down. As a consequence of this, they would all have been compelled to regraduate, and most of them would then have been dropped under the act as simple graduates. The court decides that they are not undergraduates, hence they were not transferred into naval cadets, but now remain in service as cadet engineers. A large number are interested in the decision.

CLOSING OF THE MASSACHUSETTS CENTRAL.—The trustees of the Massachusetts Central, who took it under the mortgage of $3,500,000, have closed the road since the means to run the road are not provided, and they have not the authority of the Supreme Court for raising such means by a charge upon the property.

FRENCH RAILWAYS.—The French Minister of Public Works has published a statement showing that 37 new lines of railway, of a total length of 640 miles, were opened for traffic in the course of last year. At the close of last year the total length of the French railways open for traffic was 16,430 miles, of which about 2,500 miles were owned by the state. The total length of the Algerian railway system was about 1,000 miles, of which 120 were opened in the course of the year.

AMERICAN RAILROAD BUILDING.—*The Wall Street News* is a firm believer in the opinion that this country is still building too much railroad. For the first four months of this year 1,450 miles were built, which is greater than for any year before except last year, when 2,300 miles were built in the same time. The estimated construction for the year is put at 8,000 miles.

ENGINES FOR CHINA.—George H. Corliss, of Rhode Island, is building the engines for the first cotton mills to be erected in China.

BELOIT WATER-WORKS.—The preliminary work of the Beloit (Wis.) Water-Works is progressing rapidly and satisfactorily. Excellent soft water in seemingly inexhaustible quantities has been found at a depth of fifty feet, and twenty pipes will be driven to furnish the estimated supply that will be required. The works are under contract to be in operation before next winter, and will cost about $100,000. The enterprise is in the hands of a private company, with ex-Mayor John Hackett President.

ADRIAN (MICH.) STREET RAILWAY.—Official announcement of the organization of the Adrian City Train and Street Railway Company was made on the 14th, the incorporators being Messrs. J. H. Blain, H. H. Osgood, Benjamin F. Graves and Henry Bowen.

NEWAYGO (MICH.) WATER-WORKS.—The citizens of this village, which was nearly destroyed by fire three weeks ago, are agitating the matter of some sort of fire protection for the future. There are several streams and lakes in the immediate vicinity, the waters of which could be utilized for the purpose at a comparatively small expense. The town is so situated that the reservoir system could be adopted very easily.

THE BIDS FOR THE NORTHERN PRISON SEWER.—MICHIGAN CITY, May 12.—The City Hall was crowded at the meeting of the Council to-night, in anticipation of the opening of the bids for the construction of the $33,000 prison sewer. The bids from parties in this city were N. F. Culbert, $8.85 per foot; Wm. Brinkman, $8.87; Wm. Ohming, $8.49. From abroad, Whitset & Adams, Indianapolis, $9.83; James O. Wright, Lafayette, $9.20; W. H. Meyers & Son, Fort Wayne, $8.47. While Meyers & Son's bid was the lowest, the Council refused to award the contract to-night, and laid it over till next Friday night, to which time they adjourned.

BESSEMER RAILS IN EUROPE.—A Portugese railroad recently invited tenders for 11,000 tons of Bessemer rails. Bids were made by German, Belgian and English works, and the contract went to Krupp, of Essen, at $24.54 per ton of 2,250 pounds. The following list of the bids will be interesting. They included delivery at some point in the exporting country, except in the three cases last mentioned:

Krupp, Essen, Prussia	$24.54
C. Cammell & Co., Sheffield	24.73
The John Cockerill Co., Seraing, Belgium	25.21
Buchum Works, Germany	27.48
Angleur Steel Works, Belgium	29.39
Cassamin & Co., Thy-le-Chateau	29.44
Horde Works, Germany	30.22
Delivered at Lisbon.	
Rhenish Steel Works, Ruhrort	29.24
Richard Oakley & Co., England	26.14
Shaw Brothers, London	28.50